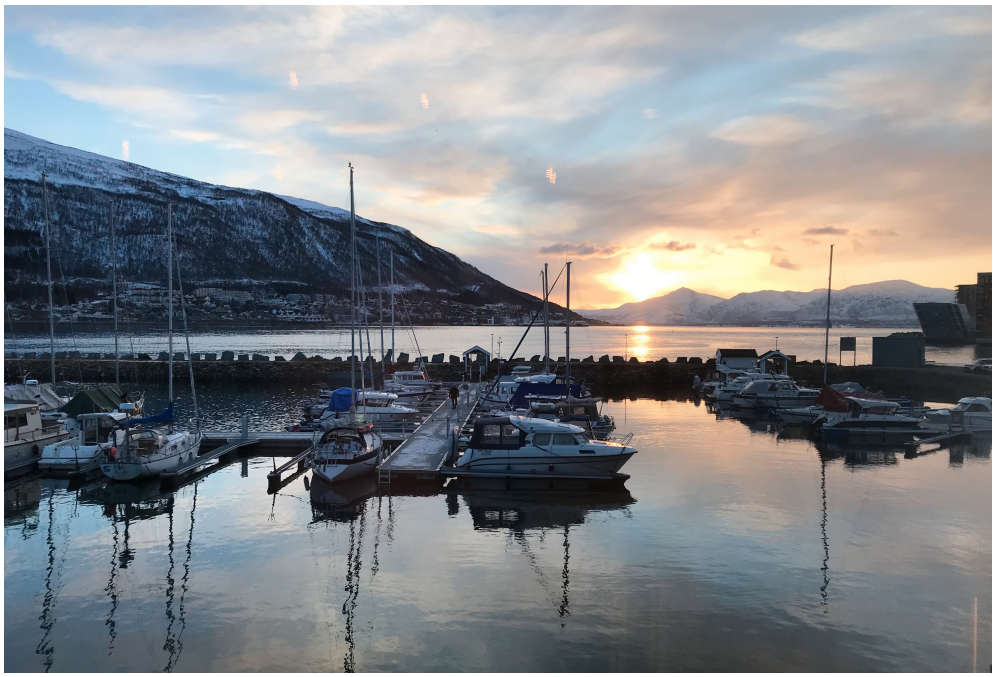
27TH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

January 25–29 2021
Online

REPORT



View from the Norwegian Institute of Marine Resources (IMR), Tromsø. Photo credit: Mana Tugend

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NAMMCO

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EXECUTIVE SUMMARY

The 27th meeting of the NAMMCO Scientific Committee (SC27) was held online January 25–29 2021. The meeting was chaired by Bjarni Mikkelsen and included observers from Japan, Russia and Makivik corporation.

WELCOME & OPENING REMARKS

The Chair welcomed participants and observers to the meeting and noted that due to the pandemic, no meeting of the SC or the NAMMCO Council (CN) had been held in 2020. The reports of both SC27 and SC26 will therefore be reviewed by the NAMMCO Management Committees at the next CN meeting (CN28), scheduled for March 2021.

WORK PROCEDURES & ORGANISATIONAL UPDATES

Updates from Council: The SC was informed that a new time schedule for NAMMCO meetings had been agreed and that the SC meeting would take place early in the year, at least 2 months before the CN meeting. Furthermore, according to revised rules of procedure documents for all NAMMCO meetings now needed to be delivered 2 weeks in advance.
Updates from NAMMCO Scientific Publications: Volume 11 is now complete, which finalises all analyses from the North Atlantic Survey Series (NASS). There is now an open call for Volume 12 ready for circulation amongst relevant networks.
Review of NAMMCO Management Areas: The SC reviewed and agreed upon tabular overviews of the sub-areas the SC uses in its management advice for pinnipeds and cetaceans.
Review of Abundance Estimates Overview: New overview documents for all abundance estimates produced and endorsed within NAMMCO were presented. The SC agreed that estimates endorsed by the SC, which are then revised before being published in the scientific literature should be reviewed in their final form by the abundance estimates working group (AEWG) and the SC for approval, following the same procedure as for new estimates.
Review of NAMMCO website: The SC quality controlled the information provided on the NAMMCO website for the minke whale, pilot whale, harbour seal and walrus. Revisions and updates were provided as necessary and the text endorsed.
Collaboration within the SC: The SC established a sub-group to update the collaborative 'super-tag' project description, including the in-kind contributions from all member countries. The revised description will be submitted for consideration at CN28 and the SC agreed that non-NAMMCO countries were welcome to join as project partners.

WORKING GROUP (WG) & WORKSHOP REPORTS

By-catch Working Group (BYCWG): Online meeting 28 May 2020.
Estimates for by-catch of marine mammals in Icelandic lumpsucker gillnets were reviewed. The SC *endorsed* the stratified estimates and *recommended* the estimates with stratification by management area for use in assessments. Revised estimates for harbour and grey seal by-catch in Norwegian coastal commercial fisheries were also reviewed but not endorsed for use in their current form. Given that the estimates were approaching levels similar to direct catch in some cases, the SC *agreed* that it was crucial that by-catch be included in the upcoming assessments of coastal seals. Noting that generating reliable estimates was challenged by ongoing problems with accurate identification of by-caught seals in Norway and Iceland, the SC *reiterated the recommendation* that this be improved, e.g., through jaw or flipper collection, DNA analysis, and/or photographs. The limitations and lack of reliability of self-reporting for estimating by-catch were again underlined and the SC *endorsed* the BYCWG recommendation that additional sources of information always be sought. The SC also *recommended* that the BYCWG provide to the next SC meeting an update on the effectiveness of video monitoring systems (being trialed in Norway and in use elsewhere), together with an update on the use of pingers as a by-catch mitigation measure. Following a discussion within BYCWG on a corrigendum to the by-catch reported in the Faroe Islands between 2013–2018, the SC *recommended* that data from all member countries on both catch and by-catch be validated before submission to formal databases and repositories. The SC *endorsed* all the recommendations for research from the BYCWG. The SC also agreed with the proposal of the WG to continue fulfilling its ToRs by reviewing the extent of all fisheries and associated by-catch risks. The next meeting of the BYCWG is planned for 2021.

NAMMCO-JCNB Joint Working Group (JWG): Online meeting 26–30 June 2020.
Narwhal: No management advice was given for narwhals at the JWG meeting because the West Greenland abundance estimates and correction factors required a more focused review. Updating the metapopulation and allocation model could therefore not be finalised during the meeting. A quantitative subgroup (QSG) was established to work intersessionally on this review and its advice will be reported at the next meeting of the JWG in autumn 2021. The JWG was informed that preliminary results from ongoing genetic analyses indicate three main populations (West Greenland-Eastern Canada, East Greenland and North-East Greenland-Svalbard) and a possible genetic distinction in East Greenland between narwhals that summer in Scoresby Sound and those that enter in the spring. Information from satellite tracking in Eclipse Sound also indicate that some narwhals are visiting two summering grounds. A new abundance estimate for Eclipse Sound (12,039; 95% CI: 7,768–18,660) was *endorsed* for use in assessment, however the estimates from an aerial survey performed by Golder Associates Ltd. for Baffinland Iron Mines Corporation required further discussion. For

Melville Bay and Inglefield Bredning, it was agreed that the choice of models and correction factors required more discussion within the QSG before they could be accepted. A significant decline in the area of narwhal sightings in Melville Bay was noted as indicating a possible population decline. Updated catch statistics were presented and accepted, with the JWG highlighting that the level of hunting in the Melville Bay Nature Reserve had increased. To assist determinations of maturity, the SC *endorsed* the JWG recommendation that hunter reports include the body length of the animal.

Beluga: The JWG was informed that ongoing genetic analysis preliminarily indicates at least 5 genetically distinct groups in the western Atlantic, with finer level structuring possible in some groups. A new abundance estimate for the eastern part of the North Water from the aerial survey in April 2018 (2,063; 95% CI: 513–8289) was *endorsed* for use in assessments, as well as catch statistics from Greenland and Nunavut. Following a precautionary approach and a request from Greenland, the JWG performed an assessment of beluga in the North Water as a separate stock. The placement of a border at Cape York to separate the West Greenland and North Water stocks was deemed most reasonable based on the available evidence from satellite tracking, timing of catches, and genetic data. The population assessment for West Greenland was updated and a new assessment developed for the North Water. *Management Advice-West Greenland:* To maintain a 70% probability for population increase, an annual landed catch of no more than 265 individuals south of Cape York and north of 65° was recommended. *Management Advice-North Water:* To maintain a 70% probability for population increase, an annual landed catch of no more than 37 individuals north of Cape York was recommended. The SC *endorsed* all the recommendations for research and conservation and management from the JWG and *reiterated its recommendations* that there be seasonal closures and no hunt of beluga south of 65˚.

Coastal Seals Working Group (CSWG): Online meeting 1 January 2021.
Iceland was unable to attend the meeting, so the focus was on reviewing status updates in other member countries.
Harbour seals: In Norway, the survey cycle will be completed in 2021 when the remaining areas in Finnmark will be covered and a full population assessment will then be performed. From 2016–2020, harbour seals were counted at haul-out sites from the Swedish border to Troms, resulting in a total minimum count of 5,579. This represented a decrease from 6,383 in the same area during the 2011–2015 survey cycle. The largest drop was in Troms and Nordland, with an increase in the Norwegian Skagerrak.
In Greenland, three populations are recognized and monitored. One of them (the population in Kangerlussuaq) is critically endangered while the populations around Majorariaq and Qeqertat are small (likely less than 100 seals each) but show signs of increase. Most of the southeast coast, and some glacier fjords and river systems on the west coast, could potentially host undiscovered population and the SC *endorsed* the recommendation that it was important to further investigate this. The SC also *endorsed* the CSWG recommendation that due to significant errors in the historical catch statistics on harbour seals in Greenland (likely due to inaccurate reporting on the species caught), NAMMCO should consider removing this information from its website.

Grey seals: In Norway, the total number of grey seals was estimated to be 3,850 animals in 2016 (95% CI: 3,504–4,196), which was down from 7,120 (95% CI: 5,710–8,540) in 2011. Surveys in Trøndelag and the southern part of Nordland in 2014 and northern Nordland (including Lofoten) in 2015 showed a significant decrease in pup production. A small reduction was also observed in Troms in 2016. Pup production in Trøndelag and along the mainland coast in Nordland remained at the same low level in 2018, while pup production in Lofoten (Nordland) had almost doubled in 2020 compared to 2015.
The Faroe Islands counted grey seals at haul-out sites during 2018 and 2019, which yielded a minimum count of 550 animals. More accurate estimates will be generated through tracking data, with two animals tagged in 2020 and plans to increase this up to 10 seals. There are also plans to monitor haul-out and breeding sites by camera to enable comparison with survey data. The level of kill around fish farms levels has steadily declined over the last 10 years (from as high as 200 animals/year to near zero), which the SC agreed should allow the population to recover. The SC noted that killing seals at fish farms is now banned in all member countries. It *endorsed* all of the recommendations for research from the CSWG as well as the recommendation that assessments be performed as soon as the necessary data becomes available. It also *agreed* that developing biologically relevant management units, rather than using county borders in Norway, was important. The next meeting of the CSWG is planned for 2022.

NAMMCO-ICES Joint Workshop on Seal Modelling (WKSEALS): Online meeting 4-6 November 2020.
At the 2019 meeting of the ICES/NAFO/NAMMCO working group on harp and hooded seals (WGHARP), the assessment model used for the NE Atlantic was not able to reproduce observed trends in pup production and could not generate reliable future projections for management advice. To improve the model for future assessments, WGHARP recommended that an expert workshop be held, followed by a full ICES benchmark process. WKSEALS brought together experts on seal population modelling from across the North Atlantic. It focused on harp, hooded and grey seals, for which assessments are all based on estimates of pup production and models that use some form of age-structured population dynamics. The workshop compared the approaches used across species and regions and performed pilot modelling

experiments to explore potential solutions to the identified problems. Based on this work, WKSEALS recommended various ways to improve the model used for NE Atlantic populations of harp and hooded seals (e.g., through data and model exchange, reassessing late term abortions, and modifying model structure to include interannual variations in mortality, density dependence on vital rates, and environmental co-variate data). All recommendations from WKSEALS were *endorsed* by the SC. These recommendations for model development will be further explored and implemented over the coming year, with the results to be used as inputs to the benchmark process in 2022 and WGHARP in 2023.

ECOSYSTEM ISSUES

Marine Mammal-Fisheries Interactions: Updates on recently published research included work on harp and ringed seal diets and determining the trophic position of predators such as these in food web structures. It also included new analyses indicating that harbour seals are not in serious direct competition with local fisheries along the Norwegian coast and that predation by seals is not an important factor preventing the recovery of depleted coastal cod stocks. Plans of the joint Norwegian-Russian research program on harp seal ecology to deploy satellite tags in the White Sea were also presented.
Multi-species Approaches to Modelling: Updates from recently published research on determining the weight of minke whales was presented, as well as ongoing work on an article estimating consumption in the North Atlantic. The SC agreed that updates on work being done within relevant ICES integrated assessments should be presented at its next meeting.
Other Environmental Issues: The SC received an update on the Mary River mine project, noting that Greenland and Denmark had brought issues related to transport and shipping to ESPOO so that transboundary impacts could be considered within the environmental impact assessment. The SC *endorsed* the JWG recommendation that a workshop be held to assess the impacts of disturbance from the Mary River mine on narwhals, beluga and walrus, although it asked the JWG to provide more specific terms of reference. Updates from recently published research on harp seals as monitors of change and ongoing research projects on human activities and stressors in the Barents Sea and along the Norwegian coast were also provided. The SC *recommended* that all NAMMCO member countries ensure that relevant information from seismic surveys be made available to enable proper sound estimation and impact assessment.

PINNIPED STOCKS

The responses of the SC to all species-specific requests from the CN can be found in the report, while any relevant updates that were provided are summarised below.
For ***harp and hooded seals***, updates on relevant advances in the assessment model were presented in the WKSEALS report, while updates on the status of ***grey and harbour seals*** were provided in the CSWG report. For ***ringed and bearded seals,*** the SC noted a recent request from CN that WG meetings to assess the status of these species should not be delayed beyond 2022. The SC agreed that as a first step, an overview of the information required and available to perform assessments should be generated, together with a review of current literature. The new intern starting at NAMMCO in February 2021 will be tasked with producing this overview. No specific updates were presented for ***walrus*** at SC27, although this species was included as a co-target for the endorsed workshop to assess the impacts of disturbance from the Mary River mine project.

CETACEAN STOCKS

The responses of the SC to all species-specific requests from the CN can be found in the report, while any relevant updates that were provided are summarised below.
Humpback whale: An update on the research collaboration on North Atlantic humpback whale satellite tracking was provided. It was noted that tagging and metadata (including biological information) have now been shared within the group and that analysis will begin in spring 2021.
Beluga: Updates for beluga were presented in the JWG report.
Narwhal: In addition to the information provided on narwhals in the JWG report, the SC received a specific update on narwhals in East Greenland. It was noted that the advice from SC26 that harvest in all three management units in southeast Greenland (Ittoqqortoormiit, Kangerlussuaq and Tasiilaq) should be reduced to zero had not yet been reviewed by the Management Committee for Cetaceans (MCC) due to the cancellation of meetings in 2020. The SC was informed that quotas set for these three areas in 2020 totaled over 50 animals. The SC reiterated its concern for the status of narwhals in East Greenland and the high risk of extirpation of the stocks if harvest at any level continues.
Bottlenose whale: The first abundance estimate from the Norwegian mosaic survey 2014–2018 (7,800; 95% CI: 4,400–13,900), was *endorsed*. The SC *recommended* a single estimate for the whole Faroe-Iceland-Norway area be produced.
Killer whale: The first abundance estimates from the Icelandic/Faroes NASS ship surveys were *endorsed*. Due to the low numbers of sightings and high encounter rate variance, estimate precision was low. The SC *endorsed* the 2015 estimate for the Faroe-Iceland-Norway areas as the more robust for use in assessment (22,100; 95% CI: 15,300–32,000).
Pilot whale: The Faroe Islands provided an update on the information available to inform an assessment. Abundance estimates for the Central North Atlantic from the Icelandic and Faroese shipboard surveys in 2007 and 2015, and an analysis of trends in relative abundance in the Northeast Atlantic, are now published. Life history information would be

updated in 2021 through an analysis of teeth and ovary samples. Tracking data for 10 pods is also available. Greenland also informed the SC that it had catch statistics and two abundance estimates available, but no biological samples.

Dolphins: The information currently available to inform an assessment was presented by all member countries. In the Faroe Islands, biological samples collected from white-sided dolphins in 2001–2009 have been analysed for sex and age composition, life history, feeding habit and genetics. Abundance estimates of white-sided dolphins from the Icelandic and Faroese components of the 2007 and 2015 NASS have also now become available. Iceland noted that in addition to abundance estimates, it had some information on by-catch and a few biological samples from strandings. Greenland informed that it had abundance estimates and catch statistics available. A dedicated sampling program has also been proposed for white-beaked dolphins in East Greenland and two different names for white-sided and white-beaked dolphins now introduced, which will allow for more specific catch reporting. The SC saw a possibility to assess white-sided dolphins in the Faroe Islands on the basis of the information available, but concluded that there was insufficient information to carry out a full assessment for other species and areas. Work on dolphins was therefore encouraged to continue, with the information available updated and reconsidered at SC28 in 2022.

Harbour porpoise: Updates were provided from three published papers based on analyses of samples from by-caught harbour porpoises in Norway. This research suggested that harbour porpoises in Norway likely belong to a single population, that the species can potentially be used as tracers for plasticisers in marine environments, and that mercury concentrations were in the no risk category. The SC noted that the advice for West Greenland from the harbour porpoise WG in 2019 had not yet been reviewed by the MCC due the cancellation of meetings in 2020 but would be done in 2021.

Sperm whale: An update from a new tagging study of sperm whales in Svalbard was presented.

Bowhead whale: Information on the status of the East Greenland-Svalbard-Barents Sea stock was presented, indicating that this stock may now be recovering from commercial exploitation. Large abundance estimates over the past decade indicate a healthy stock of at least several hundred bowhead whales between East Greenland and Franz Josef land.

Surveys

All the abundance estimates that could be generated for species covered by the previous NASS have now been completed and published, finalising data analysis from 30 years of survey efforts. The SC *agreed* that based on the new information provided by member countries, 2024 was now the most appropriate year for the next coordinated survey. The established planning sub-group agreed to draft a proposal for the new coordinated survey, circulate this to SC members for review by correspondence, and then submit it for consideration at CN28.

Future Work Plans

The SC again highlighted the technical difficulties with generating formal assessments for very small populations, and the high risks associated with continued exploitation of populations too small to be properly assessed. The SC therefore *reiterated its recommendation* from 2019 that the NAMMCO Management Committees support the development of a standard or principle-based approach for how to manage small and/or depleted stocks. The SC also suggested that this be a topic on the agenda for SC28 to begin the discussion and advance the development of such an approach.

Based on the information presented as SC27, the following workplan was agreed and the budget reviewed and revised accordingly. While no workshops were scheduled in the coming years, plans for addressing the endorsed workshop topics within WGs are outlined in the report.

2021	2022	2023
Working Groups: - Narwhal in East Greenland - NAMMCO-JCNB JWG on Narwhal and Beluga - By-catch **Other:** - NASS Planning (online) - Harp & Hooded Seals Benchmark kickoff (online)	**Working Groups:** - Bearded Seal - Ringed Seal - Harbour Porpoise - Coastal Seals - Pilot Whale **Other:** - Harp & Hooded Seals Benchmark Meeting	**Working Groups:** - Harp & Hooded Seals - Dolphins

Any Other Business

It was agreed that since SC27 took place online, Greenland would remain the host for SC28 in 2022, with the precise date and location for the meeting to be determined at a later time.

Meeting Close

Before closing the meeting, the Chair drew attention to plans of long-term SC member Tore Haug to retire in 2021. The SC thanked Tore for his extensive contributions to NAMMCO and wished him well in his retirement.

MAIN REPORT

1. WELCOME AND OPENING REMARKS

The participants and observers at the 27th meeting of the NAMMCO Scientific Committee were welcomed by the Chair, Bjarni Mikkelsen. A particularly warm welcome was extended to the newly appointed member to the SC from Norway, Martin Biuw. The Chair noted that this meeting of the SC was not held at the end of 2020 as had initially been planned due to travel restrictions connected to the corona virus, and the decision from the NAMMCO Council in 2020 to a change in the timing of the NAMMCO meeting schedule. According to the newly agreed schedule, the annual meeting of the SC will now be held at the beginning of the year, at least 2 months prior to the Council meeting. The 27th meeting of the NAMMCO Scientific Committee (SC27) was therefore rescheduled for January 25–29 2021. The Chair then informed the group that due to the restrictions and uncertainties connected with the corona virus, the 28th meeting of the NAMMCO Council had also been postponed from March 2020 to March 2021. This means that the report of the 26th meeting of the Scientific Committee (SC26) from 2019 has not yet been presented to the NAMMCO Management Committees or Council. The intention is therefore to present the reports from both the 26th and 27th Scientific Committee meetings to the 28th Council meeting, which is now scheduled for 22–26 March 2021.

A brief round of introductions was made and the full list of participants and observers at the meeting can be found in Appendix 2 of this report.

1.1 ADOPTION OF AGENDA

The Chair outlined the changes that had been made to the traditional SC meeting agenda to help facilitate this as an online meeting. The draft agenda for the meeting was adopted without amendment and is available in Appendix 1 of this report.

1.2 APPOINTMENT OF RAPPORTEURS

The NAMMCO Scientific Secretary, Fern Wickson, was appointed as rapporteur, with agreement that convenors and committee members would submit short written summaries on agenda items as relevant and other members of the Secretariat would assist as required.

1.3 REVIEW OF AVAILABLE DOCUMENTS

The Chair noted that the list of documents for the meeting was available to all (Appendix 3). Specific attention was drawn to the fact that despite the disruptions to travel and meetings that occurred throughout 2020, meetings of three working groups had been held, as well as a collaborative workshop together with ICES. The reports from these meetings were presented and reviewed by the SC, together with the documents providing species specific updates and new research on environmental and ecosystem issues. It was noted that national progress reports from NAMMCO members and observer reports submitted by Japan and Makivik Corporation were also available as meeting documents (see also Annex 1 and Annex 2 of this report).

2. WORK PROCEDURES & ORGANISATIONAL UPDATES

2.1 UPDATES FROM COUNCIL

The General Secretary of NAMMCO, Geneviève Desportes, provided an overview of recent decisions from the NAMMCO Council that directly concern the SC. This included:

a) Council has now agreed on a new time schedule for NAMMCO meetings. Specifically, Council agreed that the SC meeting could be moved to the beginning of the year and held shortly before the Council meeting, although it required that there be a minimum of 2 months between the meetings of the SC and the Council.

b) There has been a revision to rules of procedure for all NAMMCO committees and Council and requiring that all meeting documents be delivered 2 weeks before a NAMMCO meeting.
c) The Council has requested that the ringed & bearded seal working groups not be delayed beyond 2022.

It was noted that the SC had previously discussed the revision to the rules of procedure with the Chair of the NAMMCO Council, Kate Sanderson, via correspondence and that this exchange was available in meeting documents SC/27/FI05 and SC/27/FI06.

Further discussion regarding the ringed and bearded seal working groups can be found under section 6.3 and 6.6 respectively.

2.2 UPDATES ON THE NAMMCO SCIENTIFIC PUBLICATIONS SERIES

Volume co-editor, Rikke Hansen, informed the SC that Volume 11 of the NAMMCO Scientific Publications series "Sighting Surveys in the North Atlantic: 30 years of counting whales" was now published and that this represented the finalisation of all NASS analyses. This Volume includes 11 research articles, as well as two technical notes - one on the Geometer and the other on the abundance estimates endorsed by the NAMMCO SC. The SC gratefully **acknowledged** the hard work from editors, authors, reviewers, and the Secretariat that had gone into finalising this volume.

Wickson highlighted that as agreed at SC26, there would be an open call for submission of papers to Volume 12 under the general theme of marine mammals in the North Atlantic. The text of this call was provided in SC/27/FI07. It was noted that submissions could include papers presenting biological research, but that the volume was also open to research from other disciplines such as economics and law. The SC was also informed that for the journal to remain listed in the Directory of Open Access Journals (DOAJ), it needed to publish at least 5 peer-reviewed papers a year. The SC **agreed** to distribute the open call for papers broadly amongst its networks.

2.3 REVIEW OF NAMMCO MANAGEMENT AREAS

Desportes presented document SC/27/10 with a tabular overview of areas used by the SC in its assessments for all species in NAMMCO. Noting that a version of this document had previously been presented at SC26, she asked the SC to specifically review the changes made since the last meeting.

The accuracy and appropriateness of the terminology used in the document was discussed. Following this discussion, the SC **agreed** that the following terms should be used: regions and/or management areas, and sub-areas of direct relevance to NAMMCO. Furthermore, it **agreed** that the term "protected" should only be used in cases where 0 catch has been formally recommended and implemented, thereby distinguishing it more clearly from areas where the species is simply not utilised. The SC also asked that the table be accompanied by some introductory text explaining that this is not a formal definition of NAMMCO management areas but rather a description of the areas currently in use within the organisation and that as such, it remains a living document. Greenland clarified that the table should include three areas for belugas in West Greenland (North Water and West Greenland North and South of 65˚) and that harp seals from the Greenland Sea were also caught in Greenland.

It was noted that it would be valuable to have an additional column or colour code in the table to indicate the quality of the knowledge available for each of the species/areas. This will be worked towards once agreement on the area descriptions has been reached.

The endorsed versions of these tables are available in 57 of this report.

2.4 REVIEW OF THE ABUNDANCE ESTIMATES OVERVIEW

Desportes informed the SC that in addition to the overview of what are considered to be the best available abundance estimates (endorsed and/or published) for the different areas and species that was published in Volume 11 of the NAMMCO Scientific Publications in 2020, an extended version of this overview that also contains all endorsed abundance estimates (some having since been

superseded) is available as a living document on the NAMMCO website. In generating these overview documents, it was noted that there are occasions where estimates presented in the published literature by NAMMCO associated scientists differ from those endorsed by the SC. The SC was therefore asked to define the appropriate procedure for considering abundance estimates that have been updated and/or amended in publications after they have been endorsed by the SC in an earlier form.

The SC **agreed** that all new abundance estimates should be presented to a meeting of the Abundance Estimates Working Group (AEWG) for their consideration, and that recommendations from the AEWG then be forwarded to the SC for their approval, i.e., follow the same procedure as for new estimates.

The SC expressed its appreciation that all the data from the NASS had now been analysed and the abundance estimates finalised.

2.5 REVIEW OF SPECIES PAGES ON THE NAMMCO WEBSITE

Following the procedure agreed at SC26 in 2019, the SC was asked to review the information on the NAMMCO website for four species. This year the selected species were: common minke whale, pilot whale, walrus, and harbour seal. The SC was asked to ensure that the information was accurate and updated with the latest scientific research. The SC members reviewed this information and provided the Secretariat with updates throughout the meeting. This review was completed within the two weeks following the meeting and the information provided **endorsed** for use on the NAMMCO website.

2.6 COLLABORATION WITHIN THE SC

2.6.1 The Super-tag Project

Wickson informed the SC that Norway and the Faroe Islands had indicated to the NAMMCO Finance and Administration Committee (FAC) that they could find funding to support the Super-tag project. The FAC then asked the SC to provide an updated project description, including the new timeline for the project and any updates necessary on the technical plans, as well as a quantification of the expected in-kind participation from all four member countries.

Japan has also indicated that it is interested in participating in the project. Japan noted that they saw a possibility to improve the project description by including a more detailed articulation of how the scientific collaboration between NAMMCO and non-NAMMCO members would be conducted and advanced through the project.

During the discussion it was noted that the project contains three main elements - tag development, testing of tag performance and deployment methods, and scientific research using the tags. In-kind funding may be directed towards both latter components, while a specialist company would be paid to carry out the work of tag development. It was also clarified that any tag deployment activity would now not be likely to occur before 2023. Given the challenges in calculating in-kind contributions in concrete terms at this early stage, it was accepted that information on these types of contributions listed in the updated project description would necessarily be provided as estimates rather than a firm commitment at this point.

The SC established a sub-group with participants from each member country to update the proposal and include estimated in-kind contributions. The coordinator of the project description (Mads Peter Heide-Jørgensen) noted the intention to circulate a revised project description to the SC in the coming weeks and an aim to deliver a final updated project description to the next Council meeting in March 2021.

An online meeting of the sub-group was held in between plenary sessions of the SC meeting and established that approximately 13 million NOK would be made in in-kind contributions from the national scientific research institutes. The total project budget had increased slightly due to changes in currency exchange rates and the addition of a budget for the NAMMCO Secretariat to administer

the collection and storage of data. The SC welcomed non-NAMMCO countries to join the project as partners and suggested that this be coordinated through the Secretariat.

3. WORKING GROUP REPORTS

3.1 BY-CATCH WORKING GROUP (BYCWG)

Convenor of the By-Catch Working Group (BYCWG), Desportes, provided an overview of the report from the meeting held on 28 May 2020 (document SC/27/05), which was the 5th meeting of the Group. All four NAMMCO member countries participated in this meeting.

The overall Terms of Reference (ToR) of the working group (WG) as defined by SC21 are: *1. Identify all fisheries with potential by-catch of marine mammals*; *2. Review and evaluate current by-catch estimates for marine mammals in NAMMCO countries; 3. If necessary, provide advice on improved data collection and estimation methods to obtain best estimates of total by-catch over time.* At this meeting, presentations were given on: the by-catch of marine mammals in the Icelandic lumpsucker gillnet fisheries in the period 2014–2018; the by-catch of harbour and grey seals in Norwegian gillnet fisheries; the observer effort in the Faroese fisheries, and; a *corrigendum* from the Ministry of Foreign Affairs and Culture on the by-catch previously reported for the period 2013–2018.

Iceland

The WG noted and discussed reasons behind a considerable drop in logbook reporting between 2017 and 2018. The highest rate of logbook reporting in 2017 did not match the levels reported by inspectors and for seals, the self-reported by-catch was approximately half of the estimated amount. The WG agreed that this once again highlighted the unreliability of self-reporting, even with strong incentives (such as retaining MSC certification) and the limitations of relying on self-reporting to estimate by-catch rates. The WG therefore reiterated its recommendation that additional sources of information always be sought.

The WG also noted that the ratio of different seal species varied between the logbook and inspector reports and the possibility that young seals and particularly grey and harp seals, were being misidentified and reported as harbour seals could be an issue. The WG agreed that calculating a misidentification rate based on identification from DNA samples was a valuable approach and recommended that DNA collection of by-caught seals in Iceland be continued and analysis conducted to assess the level of species misidentification.

Estimates of by-catch in the lumpsucker fisheries were presented per year and as an average for different stratification schemes (non-stratified and stratified by management areas, by depth and by month) (Table 1). The WG discussed the value of the different stratification schemes, as well as their weaknesses, and provided advice for improvements. It was agreed that the data set was challenging, but that the stratification by management areas was preferred over no stratification. The WG also reiterated a previous recommendation that a combination stratification scheme be explored (e.g., by grouped management areas and season combined). The WG endorsed the estimates of marine mammal by-catch in the lumpsucker fishery in Iceland. It agreed that all the stratification approaches could be presented as relevant but recommended that assessments use the estimates from the stratification by management area as this approach captured some of the spatial and temporal variations and characteristics of the fishery.

Information on by-catch in some other fisheries was also provided, included foreign fisheries. There was no new information available to assess by-catch in the cod gillnet fishery. The WG agreed that there was a need to revisit this issue and particularly the advice from BYCWG for how the upcoming coastal seal assessment should proceed, e.g., by either operating with no information or using the previously unendorsed estimates from BYCWG.

Table 1. Summary of the three endorsed average yearly by-catch estimates (n/year) for marine mammals for the period 2014-2018. The by-catch reported in logbooks by the fleet in 2018 are also shown for comparison. (± CV*estimate).

Species	**Stratified by management area**	**Stratified by depth**	**Stratified by month**	**Logbooks 2018**
Harbour porpoise	528 (296–760)	615 (289–941)	468 (314–669)	96
Harbour seal	1,389 (903–1,875)	1,976 (1,205–2,747)	1,422 (853–1,991)	324 (all seal species
Grey seal	989 (504–1,572)	977 (371–1,583)	1,634 (833–2,435)	
Harp seal	240 (82–398)	344 (103–585)	296 (166–456)	
Ringed seal	49 (1–98)	61 (7–115)	56 (6–106)	
Bearded seal	28 (10–46)	NA	28 (8–48)	
White beaked dolphin	0	0	0	1
Total marine mammals	**3,223 (1,225–5,221)**	**3,973 (1,509–6,436)**	**3,904 (2,303–5,505)**	**421**

Norway

The WG took note that the updated harbour porpoise by-catch estimate in gillnet fisheries, based on results from the reference fleet, was under review for publication and would not be presented to the group for endorsement at this meeting.

The WG was presented with revised and improved harbour and grey seal by-catch rates and totals in the coastal commercial gillnet fisheries, using similar data to those reported in 2017. By-catch was estimated using a stratified ratio estimator, with number of hauls and total catch as two proxies for fishing effort. The conclusion of BYCWG in 2017 was that the available data were not good enough to generate reliable estimates, particularly due to the issue of misidentification of harbour seals and young grey seals. The identification is still considered unreliable, with an unknown, but non-negligible proportion of estimated harbour seal by-catch actually being grey seal by-catch. The data and estimates available had limitations and the WG did not endorse them in their current form. However, the WG recognised that in some cases, the by-catch estimates were approaching levels similar to direct catch (effectively doubling the level of removals) and that it was therefore important to have some input on by-catch included in the upcoming assessments of grey and harbour seals. The BYCWG recommended that, since population estimates for both species along the Norwegian coast are available, all seal by-catch data be pooled and apportioned according to: 1) the relative population estimate and 2) the relative harbour seal and grey seal pup/yearling abundance in the management areas.

The WG was presented with preliminary data in other fisheries. The number of vessels involved in recreational fisheries was likely to number in the high hundreds. The WG was informed that work had begun at the Norwegian Institute for Marine Research (IMR) to assess the take of commercial fish species by the recreational fishery (Vølstad et al. 2019). This would help the estimation of by-catch in this fishery, or at least indicate the magnitude of the interaction.

Faroe Islands

The Faroese Ministry of Foreign Affairs and Culture forwarded a *corrigendum* on the by-catch previously reported for the period 2013–2018 in National Progress Reports and to the BYCWG. This

correction arose from a recent validation of the numbers reported in the electronic logbooks since their implementation in 2013. The WG agreed that this again highlighted problems associated with self-reporting of by-catch and reiterated its recommendation that self-reporting was an insufficient basis for quantifying by-catch and that independent observation and validation were necessary additional measures. The WG strongly recommended that any officially reported data, direct catch, by-catch or other, be validated before being submitted to formal databases and repositories.

An overview of a variety of qualitative independent observer data collected by inspectors and unintentionally, through scientific surveys, was presented to the WG. This data covered fisheries efforts by demersal and pelagic trawling as well as gillnets. The data review did not reveal any strong sign that whales and seals are by-caught in any significant numbers by the Faroese fishing fleet. The WG reiterated the unreliability of using self-reporting for by-catch estimation and saw an independent observer program as useful in the pelagic fleet. However, the WG also noted that the necessity for an observation scheme could also be evaluated in light of the level of by-catch risk to the population, based on the knowledge of the risk from similar fisheries in other areas.

Following up on the WG ToRs

To continue assessing the risk of by-catch across fisheries in NAMMCO waters, the WG proposed to review the information existing on the fisheries, including knowledge gaps on by-catch information and known risk, and to invest in data collection and monitoring efforts on this basis.

RECOMMENDATIONS FROM THE BYCWG

Recommendations for Research

Iceland

- Investigate ways to interpolate the missing depth data in the lumpsucker gillnet analysis.

- Further investigate the possible clumped by-catches of seals and the extent to which these are linked to a particular time period/area/net.

- Explore a combination stratification scheme (e.g. by grouped management areas and season combined).

Norway

- Before the meeting of the CSWG in November 2020, pool all seal by-catch data and apportion according to 1) the relative population estimate and 2) the relative harbour seal and grey seal pup/yearling abundance in the management areas.

All

- All papers presented to the BYCWG explain the method for calculating CV.

Recommendations for Conservation & Management

Iceland

- DNA collection of by-caught seals be continued and analysis conducted to assess the level of species misidentification.

- Population assessments use the estimates from the stratification by management area.

Faroe Islands

- All data - direct catch, by-catch or other - be validated before being submitted to formal databases and repositories.

All

- Since self-reporting is an insufficient basis for quantifying by-catch, additional sources of information (e.g. independent observation) always be sought

Discussion

Tore Haug informed the group that the paper dealing with by-catch of harbour porpoises in Norwegian waters by Moan et al. (2020) was now published (provided as SC/27/FI26). The main conclusions were that the annual by-catch ranged from 1,151 to 6,144 in 2006–2018, with an average of approximately 2,900, and that according to current abundance estimates for harbour porpoises in Norwegian waters, this level of by-catch was unsustainable. In 2013–2018, however, a significant reduction seems to have prevailed to an annual average of around 1,600, which is sustainable. A possible reason for this reduction in by-catch was reduced effort in the monkfish fishery.

The group was informed that work to estimate seal by-catch in Norway is ongoing but is challenged by low levels of by-catch in the coastal reference fleet, which makes statistical analysis difficult. It was also noted that there are ongoing experiments with pingers in Icelandic fisheries (preliminary results not particularly encouraging) and that the use of pingers had been made mandatory in some parts of

Norway, which had created some controversy. The SC was also informed that testing of the use of automatic video monitoring systems on fishing vessels is taking place in Norway.

Gísli Víkingsson gave a short update on the OMF (Ocean Modelling Forum) marine mammal by-catch working group (WG). This WG met 4 times during 2018–2019 to discuss scientific aspects related to the US Marine Mammal Protection Act Import Provisions, involving import ban/restrictions on nations that do not adhere to by-catch standards comparable to those of the U.S. This work has focused on development of scientific tools to "evaluate data sets and methods for determining by-catch rates for marine mammal populations in terms of evaluating impacts on populations". So far, this work has resulted in four publications, some focused on specific fisheries (Iceland and Chile) and others more general, e.g., on methods to estimate the effects of marine mammal by-catch in data-poor situations (Punt et al., 2020a, 2020b, 2020c, 2021).

The SC **endorsed** the recommendations of the BYCWG, with the following amendments and additions. The SC **recommended** that the validation of any data before submission to formal databases and repositories should be a general recommendation for all NAMMCO member countries and not just the Faroe Islands. There was a discussion regarding how NAMMCO member countries could improve the data available on by-catch. For example, by supporting methods of data collection in addition to self-reporting and coastal reference fleets, such as observer programs or the use of automatic video monitoring systems. It was **agreed** that the SC should see the results of the ongoing experiments with automatic video monitoring systems (those currently taking place in Norway and elsewhere) before making any recommendation regarding the use of this particular method. The SC therefore **recommended** that an update on the effectiveness of video monitoring systems be given at the next meeting of the BYCWG. The SC also **recommended** that the research on the use of pingers in by-catch mitigation be collated and presented at the next meeting of the BYCWG. Finally, the SC **reiterated** previous recommendations that species identification of by-caught seals be improved (e.g., through jaw or flipper collection, DNA analysis, and/or photographs).

The SC also **agreed** that the next meeting of the BYCWG should take place before the next meeting of the Coastal Seals Working Group (CSWG) so that endorsed by-catch estimates would be available as inputs to the assessments of coastal seals.

3.2 NAMMCO-JCNB JOINT WORKING GROUP ON NARWHAL AND BELUGA (JWG)

The convenor of the NAMMCO-JCNB working group, Rikke Hansen provided a summary of the report (working paper 06) from the meeting that was held 26–30 June 2020 under the leadership of Co-Chairs Cortney Watt (JCNB) and Roderick Hobbs (NAMMCO).

The Terms of Reference for this online meeting were to: *a) review information on abundance, distribution, movements and harvest locations of narwhal and beluga; b) update and review the narwhal allocation model to assign harvested animals to individual summer stocks*.

Given the restrictions on time associated with this needing to be an online meeting, three additional terms of reference were deferred to the next JWG meeting, which it is hoped can take place in person in 2021. This included: a) review the latest abundance estimate for East Greenland narwhal; b) assess the impacts of climate change on narwhal and beluga movements, distribution, population dynamics, habitat and hunt methods, timing and location; c) revise advice models to incorporate climate change impacts where information is available and identify additional information requirements.

In addition, the JWG did not manage to address all the terms of reference related to narwhal within the timeframe of the meeting and therefore no management advice for narwhals was provided. This was because the abundance estimates presented for West Greenland, including their corrections for availability and perception bias, required a more focused review and updating the narwhal metapopulation and allocation model could therefore not be finalised during the meeting. To address this, a quantitative subworking group (QSG) was established to work intersessionally. The terms of reference for this QSG are available in Appendix 4 of the JWG report and the outcomes of the

subgroup's work will be presented to the next meeting of the JWG. Despite not finalising management advice, the issues related to narwhals that were discussed and agreed upon by the JWG are outlined below.

Narwhal

Genetic analysis has revealed that nuclear markers are more suitable than mitochondrial genomes for inferring population structure for narwhals. While technical issues have delayed the completion of a range-wide analysis of population structure, preliminary results indicate three main populations of narwhals: West Greenland-Eastern Canada, East Greenland and North-East Greenland-Svalbard. Preliminary results on the fine-scale genetic structure in East Greenland also indicate that the narwhals that summer in Scoresby Sound may be genetically isolated from the rest of the narwhals in the East Greenland, including those that enter the Sound in the spring. The research on genetic analysis will continue for the next 2 years.

Satellite tracking of narwhals in Eclipse Sound indicates that some whales are visiting two summering grounds. It was noted that such movements may be observed now because the tagging was conducted later in the season or because the animals are responding to environmental changes or industrial developments in the region. The JWG noted the relevance of understanding the fraction of the areas used by the animals to determine potential impacts on management advice but agreed that the new tagging data were suitable for use in the availability matrix of the allocation model.

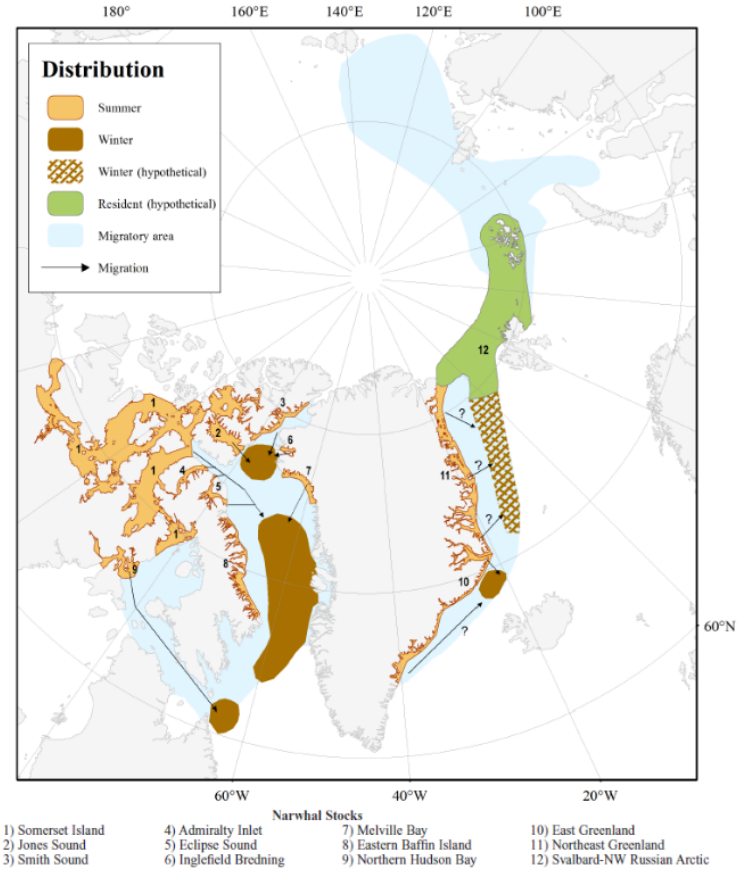

Figure 1. Narwhal stocks as recognised by the Global Review of Monodontids (Hobbs et al. 2019)

Abundance estimates for Eclipse Sound, Inglefield Bredning and Melville Bay were presented (see Figure 1 for stock locations). In *Eclipse Sound*, an abundance estimate (corrected for availability bias) of 12,039 narwhals (CV= 0.23, 95% CI: 7,768–18,660) was accepted for use in the allocation and population models. Estimates from an aerial survey performed by Golder Associates Ltd. for Baffinland Iron Mines Corporation were discussed and although the survey was deemed sound, the choice of estimates most appropriate for use and the calculation of the associated CVs were seen to require further discussion and analysis.

For *Inglefield Bredning and Melville Bay*, estimates from a summer 2019 aerial survey, together with results from a reanalysis of previous surveys, were presented. In *Melville Bay*, a high number of sightings on a small number of transect lines in one stratum complicated the analysis. Different models were used to analyse the data, which generated different estimates. It was particularly noted that between 2007 and 2019, there had been a significant decline in the area narwhals were sighted in *Melville Bay*, which may indicate a population decline. Given the challenges in analysing the 2019 survey data, and the fact that the recalculated abundance estimates from earlier surveys were lower than those previously produced, the JWG agreed that the choice of models and

correction factors required more in-depth discussion before the estimates could be accepted for use. This discussion and work to finalise acceptable abundance estimates will therefore continue within the QSG.

Catch statistics from Canada for the period 1970–2019, and an update on catch statistics in Greenland for the period 2005–2019, were presented and accepted for use in the population models. An in-depth analysis of hunting in Melville Bay was provided and the JWG highlighted that the level of hunting taking place within the Melville Bay Nature Reserve has increased between 2005–2019. To assist with accurate determinations of maturity, the JWG recommended that reports from hunters in both Greenland and Canada include the body length of the animal.

Management advice and further recommendations will follow the findings of the QSG and a subsequent meeting of the JWG in late summer/early fall 2021.

Beluga

Genetic analysis of full genome sequences indicates at least 5 genetically distinct groups of belugas in the western Atlantic, with preliminary fine-scale analysis also revealing further sub-structuring in some of these groups. Work continues to finalise this analysis, examine divergence times, and identify local genomic adaptations. The JWG also highlighted productive areas for future genetic research to help inform management advice. It was also recommended that genetic analysis of fall catches in the Qaanaaq area be conducted to establish stock structure.

No new data from satellite tracking of belugas was presented. However, the JWG recommended a half day workshop to exchange knowledge on effective tagging practices to improve tag retention. A new abundance estimate for the eastern part of the North Water based on a visual aerial survey conducted in April 2018 was presented. The fully corrected estimate of 2,063 (CV=0.81, 95% CI: 513–8,289) belugas was similar to estimates from the 2014 survey and was approved for use in the assessment.

Catch statistics for the Nunavut communities since 2011, and an update for Greenland focused on the period 1993–2019, were presented and accepted for use in the population assessment model.

There was a recognised need to examine whether beluga in the North Water (north of Cape York) are a separate population and the JWG decided to use a precautionary approach and treat this aggregation as a separate stock in the assessment (Figure 2). The decision of using Cape York as the boundary between the West Greenland stock and a possible separate stock in the North Water was based on the timing of satellite tracked belugas from the Somerset Island population and their migration route passing Savissivik around 1 October and continuing south to their wintering grounds off West Greenland. None of these tracked whales travelled north of Cape York.

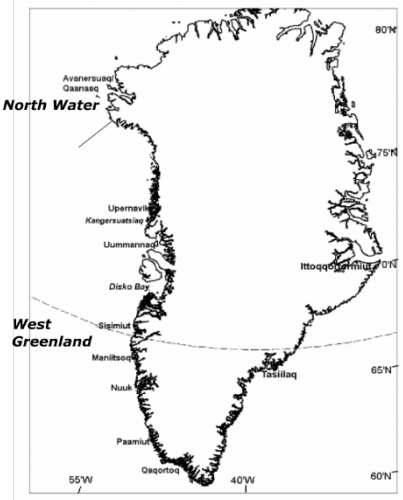

Figure 2. Boundary at Cape York used to divide North Water and West Greenland stocks

The population assessment for West Greenland was updated and a new assessment model was developed for beluga in the North Water. It was noted that following request 1.6.5 from the NAMMCO Council (2017), management advice should provide recommendations on total allowable landings rather than total removals (i.e., the number of struck and lost animals should be taken out during the calculation of a sustainable number of landed animals).

Management Advice: West Greenland

The JWG updated the assessment of beluga wintering in West Greenland based on new catch data. The catch history was re-estimated to include catches only from Savissivik and south, separating the stock component that winter in West Greenland from the component in the North Water. Assuming an initial abundance below carrying capacity, the model estimated a population of 19,800 (90% CI:

14,700–28,800) individuals wintering in West Greenland in 1970. The projection declined initially by 54% (90% CI: 68%–35%) to an abundance of 9,250 (90% CI: 6,730–12,800) animals in 2004. It then increased by 37% (90% CI: -18%–93%) to 10,900 (90% CI: 6,280–16,500) individuals in 2021 (Figure 3).

On the basis of this assessment, to maintain a 70% probability for population increase in the West Greenland stock, an annual landed catch of no more than 265 individuals south of Cape York and north of 65° was recommended.

Probability of Meeting Management Objectives	*Landed Catch of Belugas in West Greenland*
0.50	354
0.55	333
0.60	313
0.65	289
0.70	265
0.75	242
0.80	217
0.85	186
0.90	154
0.95	113

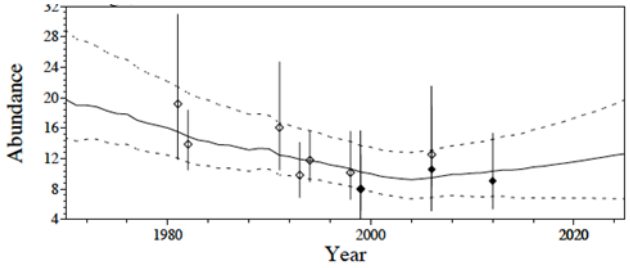

Figure 3. Projected median and 90% credibility interval for abundance in West Greenland

Management Advice: North Water

The first assessment treating the aggregation of beluga in the North Water as a separate stock was performed following the same premises and modelling framework as applied to West Greenland beluga over the past 15 years. The assessment included four fully corrected abundance estimates from 2009 to 2018, and it assumed that catches taken north of Cape York relate to the stock component of beluga in the North Water. The population model estimated an abundance of 1,690 (90% CI: 932–2,820) beluga in 1961, with an increase to 2,300 (90% CI: 1,640–3,200) individuals in 2021 (Figure 4).

Based on the assessment, to maintain a 70% probability for population increase in the North Water stock, an annual landed catch of no more than 37 individuals north of Cape York was recommended.

Probability of Meeting Management Objectives	*Landed Catch of Belugas in Qaanaaq*
0.50	44
0.55	42
0.60	41
0.65	39
0.70	37
0.75	36
0.80	34
0.85	31
0.90	29
0.95	23

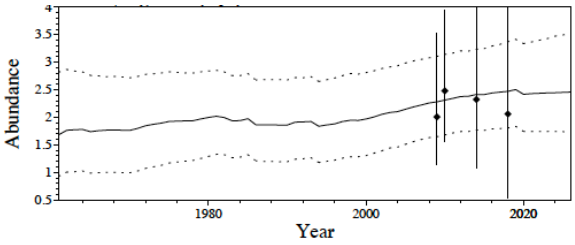

Figure 4. Projected median and 90% credibility interval for abundance in the North Water.

Under other business, an update was also given on the review of the impact assessment for Phase 2 of the Baffinland Mary River mine. The cumulative, combined and transboundary nature of the potential impacts related to icebreaking, shipping, and risk of ice entrapment were discussed. Recognising that there was insufficient time available to review the full impact assessment, the JWG recommended that an expert workshop be held to review the impacts of noise disturbance on hunted populations of narwhals, belugas and walrus from shipping connected to the Baffinland Mary River iron ore mine.

RECOMMENDATIONS FROM THE NAMMCO-JCNB JWG

GENERAL

- Hold an expert workshop to review the impacts of noise disturbance on hunted populations of narwhals, belugas, walrus and seals from shipping connected to the Baffinland mine.

BELUGA

Recommendations for Conservation & Management

- Emphasise the importance of reporting on kill dates and locations (to hunters in Canada).
- Carry out new surveys in Somerset Island in the summer and West Greenland in the winter.

Previous recommendations for conservation and management that were reiterated at this meeting:

- Implement the following seasonal closures:
    * Northern (Uummannaq, Upernavik, Savissivik): June through August
    * Central (Disko Bay): June through October
    * Southern (South of Kangaatsiaq): May through October
- In the area south of 65°N, no harvesting of beluga be allowed at any time.

Recommendations for Research

- Collate the Canadian catch statistics required to develop a joint model at a future meeting.
- Present the latest research on senescence at the next meeting and investigate how this information may be incorporated into the population model.
- Perform a genetic analysis on samples from fall catches in the Qaanaaq area to establish their stock.
- Determine summer grounds and seasonal movements and distribution of the proposed North Water stock.
- Develop a joint beluga allocation model for the High Arctic/Baffin Bay population, that will consider Greenland/Canada movement data from tagging, dates and locations of kills, and abundance data.
- Hold a half day workshop to exchange information on effective tagging practices for belugas.

NARWHAL

Recommendations for Conservation & Management

- Include body length of the animal in reporting requirements in Greenland and Canada.

Discussion

It was clarified for the group that struck and lost rates were taken into account in the assessment. Following a request from managers, the recommendations for quota were now given as total landed animals.

The specific placement of the border at Cape York for dividing the areas of the North Water and West Greenland for generating the assessment and advice on beluga was discussed. It was emphasised that quota allocation had previously been divided between West Greenland and Qaanaaq but since a technical quota had been used for Qaanaaq, no particular assessment had been performed for this area before. Two separate population assessments were conducted in 2020 following a specific request from Greenland. To perform an assessment of the two areas as requested, a boundary line between the two areas had to be determined. The JWG decided that placing the dividing line at Cape York was the most reasonable based on the available evidence. It was noted that this decision was primarily based on satellite tracking data and the migration patterns of animals tagged in Canada in the summer and the phenology of the catches in Northwest Greenland and Upernavik. It was noted that new genetic data also indicates that the animals caught in the North Water in spring are different from those hunted in West Greenland and provides support for separate assessments of the two areas.

The SC **endorsed** all the general recommendations and recommendations for research from the JWG. The SC also **endorsed** the recommendations regarding the advised catch quota for beluga in West Greenland and the North Water and noted that the government of Greenland had already implemented the quota recommended from the JWG for 2021.

The SC noted that despite its previous recommendations, there remains an annual quota for beluga south of 65˚ in Greenland, which is currently 5 animals. It also reemphasised that the aim of the

seasonal and geographical closures that have been recommended for several years but not implemented is to protect the few animals that may be present in the areas in the summer and thereby help to repopulate depleted stocks. The SC **reiterated** its recommendations that there be seasonal closures and no hunt south of 65˚.

3.3 COASTAL SEALS WORKING GROUP (CSWG)

The Chair of the Coastal Seals Working Group (CSWG), Kjell Nilssen, presented a summary of the report of the short online meeting held on 12 January 2021 (document SC/27/07). It was noted that Iceland had not been able to participate in this meeting of the CSWG so the focus had been on harbour seals in Norway and Greenland and grey seals in Norway and the Faroe Islands.

Status of Harbour Seals

Norway

Harbour seals were counted at all known haul-out sites from the Swedish border in the south to Troms in the north during the moult from mid-August to early September 2016–2020. The survey cycle will be completed at the end of 2021 when the northernmost areas of Finnmark will be covered. For the area covered during 2016–2020, the counts resulted in a total minimum of 5,779 harbour seals. This represents a decrease compared with the 6,383 harbour seals counted in the same area from 2011–2015. The largest decreases were in Troms and Nordland, while an increase was observed in the Norwegian Skagerrak. A full population assessment will be performed when the survey cycle is complete. The CSWG agreed that it was important to propose biologically relevant management units as an alternative to the current use of county borders.

Greenland

An overview of new research from tagging studies was presented, together with an evaluation of the status of harbour seals based on known human-induced mortality since the hunting ban in 2010 and an assessment of ongoing threat levels. Errors in the reported catch statistics for harbour seals prior to the ban were also presented and discussed. The conclusion was that harbour seals are severely depleted in most of west Greenland, especially in areas that used to be their stronghold. The information required to monitor the seals and assess trends is only known for three populations. The population in Kangerlussuaq is critically endangered while the populations around Majorariaq and Qeqertat are small (likely less than 100 seals each) but show signs of increase. Most of the southeast coast and some glacier fjords and river systems on the west coast can potentially host undiscovered populations. The CSWG agreed that it was important to investigate the potential presence of as yet unidentified breeding and moulting sites in these areas.

Status of Grey Seals

Norway

Historically, both surveys and model-based assessments had indicated an increasing grey seal population in Norway. However, surveys in Trøndelag and the southern part of Nordland in 2014 and northern Nordland (including Lofoten) in 2015 showed a significant decrease in grey seal pup production. A small reduction was also observed in Troms in 2016, while in Finnmark the numbers were similar to 2006. In 2016, the total number of grey seals in Norway was estimated to be 3,850 animals (95% CI: 3,504–4,196), which was down from 7,120 (95% CI: 5,710–8,540) in 2011. Pup production in Trøndelag and along the mainland coast in Nordland was at the same low level in 2018. However, pup production in Lofoten (Nordland) had almost doubled in 2020 compared to the low level in 2015. The CSWG agreed that it was important to have more accurate and comprehensive information on grey seal by-catch in gillnet fisheries and that it was relevant to review the rates of migration assumed to be occurring from populations in the UK and Russia.

Faroe Islands

During the summers of 2018 and 2019, the Faroe Islands counted grey seals at haulout sites along the coast, which resulted in a total minimum count of 550 animals. A more accurate estimate, corrected for animals missed by the survey, can be achieved through tracking data. Two animals were tagged and tracked in 2020 and there is a plan to increase this up to 10 seals in the coming years. There is also a plan to monitor haul-out and breeding sites by camera to enable comparison with survey data. Catch levels have steadily declined over the last ten years (from as high as 200 animals a year to near zero) following the 2020 law prohibiting the intentional killing of marine mammals around aquaculture facilities. The CSWG agreed that although further surveys, tagging and monitoring efforts are required, the 2020 ban should allow the population to recover.

RECOMMENDATIONS FROM THE CSWG

Recommendations for Conservation & Management

- Complete an assessment for coastal seals in each of the NAMMCO member countries as soon as the necessary data is available (e.g., within the next two years for Norway).
- Discuss the proposal that all catch statistics for harbour seals in Greenland be removed from the NAMMCO website due to known errors and a lack of validation.

Recommendations for Research

HARBOUR SEALS

- Complete the collection and analysis of DNA samples from harbour seal pups in Norway to help determine stock structure and propose more scientifically based management units.
- Enhance efforts to identify new breeding and moulting sites for harbour seals in Greenland (particularly in West Greenland) using methods that are most feasible in the different areas.

GREY SEALS

- Continue the work to provide total summer counts in the Faroe Islands and conduct ongoing monitoring of the breeding sites as well as higher resolution tracking of grey seals.
- Re-evaluate the robustness of currently assumed immigration rates of grey seals to Norway.
- Support the development of a Europe wide population model for grey seals through data provision and cooperation.

Discussion

The SC expressed its appreciation for the efforts that had been made to manage declining populations of coastal seals in Greenland and the Faroe Islands and noted that killing seals at fish farms is now banned in all NAMMCO member countries.

Whether there were any plans to develop correction factors for Norway and generate absolute rather than relative estimates was discussed. The SC was informed that some correction factors were developed in the early 1990s but that these were rather crude and improved data are required to develop more robust factors. It was also noted that different correction factors would need to be applied in Norwegian waters as the number of seals hauling out is dependent on the levels of high and low tides, which varies a lot along the coast. There is an intention to develop improved population models for harbour seals and although advancements on this had not been possible at this meeting, this was an alternative way to approach the production of absolute abundance estimates. Another alternative presented was to assess habitat usage maps available in other countries (such as the UK) and consider their potential value and relevance for application to the Norwegian context.

The inaccuracies in the catch statistics for harbour seals in Greenland were discussed. It was clarified that there are no statistics available after 2016 due to the ban on hunting and therefore the inability to validate the data and the recommendation to remove the catch statistics for harbour seals in Greenland is referring to historical catch data, not data currently being reported. The SC was informed that there had been an effort to talk to the hunters regarding the historical catch data and this confirmed that there were extensive errors and that the statistics were therefore misleading. The SC **reiterated** the importance of its recommendation that data should be validated before submission to formal repositories or databases.

The SC **endorsed** all the recommendations made by the CSWG. It was also noted that since the BYCWG had indicated that the levels of seal by-catch might be as high as catch in some cases, including by-catch in any assessment was crucial. It therefore also **reiterated** its recommendation that there is a

need to improve the species identification of by-caught seals to allow for the generation of reliable data for coastal seal management.

4. WORKSHOP REPORTS

4.1 NAMMCO-ICES WORKSHOP ON SEAL MODELLING (WKSEALS)

Martin Biuw presented the work of the collaborative NAMMCO-ICES Seal Modelling Workshop, which was held 4–6 November 2020. A draft report from this workshop was provided as document SC/27/08.

The motivation behind this joint workshop came from the latest ICES/NAMMCO working group meeting on harp and hooded seal assessment (WGHARP2019). During that meeting, it became clear that the assessment model currently used for NE Atlantic harp and hooded seals is not able to reproduce recent trends in pup production. This is especially true for the Barents Sea/White Sea harp seal stock, where the rapid decline in pup production from 2003–2005 cannot be accounted for by the model. While estimates of current population size appear relatively robust, historical trajectories do not fit pup production estimates, and future projections are unreliable and therefore not suitable as basis for establishing harvest control rules (HCRs). The reasons for the failure of the model to capture rapid changes is a deliberate decision to keep the model relatively simplistic, due to the relative data sparsity. The model estimates only three parameters: initial population size and time constant pup and adult mortality. The result of this was that WGHARP2019 recommended quotas based on the Potential Biological Removal (PBR) approach, rather than relying on HCRs based on future projected population trajectories. It was agreed at WGHARP2019 that the current models need to be revised and updated, and the WG made the following recommendations:

1. *Hold a workshop to evaluate and compare structure and data needs for various assessment models for selected northern hemisphere seals (jointly between NAMMCO & ICES)*
2. *Apply for support to carry out a full benchmark process focusing on models and data needs to improve the assessment of NE Atlantic harp and hooded seals (led by ICES).*

The joint workshop on seal modelling (WKSEALS2020) was organised as a response to the first of these recommendations and aimed to bring together experts on seal population modelling with northern seal species sharing specific life history and monitoring characteristics. The workshop focussed on harp, hooded and grey seals in the North Atlantic, for which assessments are based on estimates of pup production. Also, the focus was on assessment models that use some version of a standard age-structured population dynamics framework.

The Terms of Reference for WKSEALS2020 were to:

- *Compare population modelling approaches across regions and species*
- *Evaluate model input data in terms of:*
    - *Data types currently used and what additional data may be required*
    - *Data sampling frequency in relation to model requirements*
- *Potential environmental drivers:*
    - *Physical environmental data*
    - *Multi-species information (prey, competition etc)*

While the primary goal of the workshop was to generate a set of recommendations for future improvements to the assessment methodology for NE Atlantic populations, a secondary goal was to coordinate seal population modelling efforts across species and populations, and to facilitate collaboration and knowledge exchange across research groups. To achieve this, participants included researchers directly involved in the assessment work for the selected species and stocks in addition to external co-chairs, representatives from the NAMMCO secretariat and SC, ICES, and external invited experts. The specific issues addressed when considering assessment models included:

- Speed of model fitting
- Inference

- Use of prior information as input to inform models
- Treatment of observation processes
- Model selection strategies
- Goodness-of-fit criteria
- Ability to reproduce properties such as general variability in pup production from year to year, and observed magnitude of change in pup production from year to year
- Evaluation of parameter estimates - are they realistic and plausible?

Due to Covid19-related travel restrictions, the workshop was held as an online meeting on 4–6 November 2020, using the ICES Webex system. The meeting format consisted of plenaries, breakout sessions and a system for online sharing of data and model code. Online plenaries were held 17:00–19:00 (CET) on all workshop days, and consisted of: Short introductory presentations on selected species/stocks/models; Setting tasks for breakout groups; Reporting back from breakout groups, and; Identifying gaps and setting recommendations for work leading up to benchmark process. To accommodate participants across a range of time zones, two breakout group sessions were held in-between the daily plenaries. The first was held 18:00–20:00 (CET) on days 1 and 2, and was primarily aimed toward participants from the US and Canada, while the other was held 14:00–16:00 (CET) on days 2 and 3, primarily targeting European. These breakout sessions focused on: Exploring assessment model code and data from various species and stocks; Collaborating on specific interactive modelling tasks that could realistically be carried out during the workshop; Identifying various environmental drivers as potentially important drivers.

To facilitate the collaboration during breakout sessions, a Github repository (https://github.com/ices-eg/wk_WKSEALS-2020/) was established as a sub-repository under the ICES GitHub repository to make model code and data available to participants, and enable screen sharing for coding demonstrations. This repository will remain as a collective resource to further stimulate collaboration moving forward.

In relation to the coming ICES benchmark process for NE Atlantic harp and hooded seals, the workshop provided the following recommendations and objectives:

1. Carry out data & model exchange to compare performance across species, populations and modelling approaches. In particular, it was recommended that the NE Atlantic data should be run through the Canadian assessment model.
2. Re-assess late-term abortion as a potential cause of the mismatch between high fecundity rates and low pup production in some populations. In particular, it was suggested that Canadian harvest samples be re-examined to determine for signs of late-term abortion in animals with known late-term abortion, followed by a re-examination of harvest samples from the NE Atlantic.
3. Modify the model structure for NE Atlantic harp (and hooded) seal models to examine options for including:
    - Late-term abortion term that scales estimates of fecundity to produce more realistic estimates of natality.
    - Interannual variation in mortality to account for potential mass mortality or emigration events (following examples shown by Lars Witting & Jay ver Hoef during the workshop and in working papers).
    - Density dependence on vital rates (following examples shown by Lars Witting & Jay ver Hoef during the workshop and in working papers).
    - Include the effects of potential environmental drivers on seal vital rates and/or carrying capacity (extending the current model following initial tests by Martin Biuw, Tor Arne Øigård & Hans Skaug).

In terms of grey seals, the workshop was informed about ongoing activities to extend national assessment models to cover greater parts of Europe, taking migration between colonies into account. This is an effort driven by requests from OSPAR, and the workshop discussed approaches for also

including grey seal populations from outside the OSPAR region (e.g. populations in several NAMMCO countries).

In terms of the planned way forward, the preliminary schedule for harp & hooded seals is as follows:

1. Benchmark kick-off meeting, potentially in connection with the biennial conference on the Biology of Marine Mammals (December 2021)
2. Several preparatory online meetings/workshops
3. Benchmark meeting (December 2022)
4. Follow-up meeting to evaluate and potentially update Harvest Control Rules (spring 2023)
5. Input to assessment and advice process during WGHARP (spring-autumn 2023)

The workshop also encouraged participants to continue collaborations initiated during the meeting, and to use the GitHub repository as a live resource for such collaboration.

Discussion

The SC highlighted that the future work planned for the modelling of grey seals in Norway could also include Iceland and the Faroe Islands.

How and when to include environmental covariates was noted as an issue that has been extensively discussed in the modelling of fish stocks and that similar questions would be likely to arise for their use in seal modelling. The SC was informed that a quick experiment had been done on integrating information from the biomass indices for capelin and cod during the WGHARP2019 meeting and although this looked promising, more work was certainly required to address the issue in a thorough way. It was also noted that one of the key issues the workshop identified was that information on environmental covariates typically does not include any future projections and therefore how this information may be integrated into populations models that do make projections required further discussion and work.

The SC expressed its appreciation for the progress that had been achieved on seal model development through this collaborative international workshop and **endorsed** the recommendations presented.

It was also noted that following the workshop and the subsequently elaborated plans for a benchmark meeting in 2022, the next meeting of WGHARP was now re-scheduled to take place in 2023.

5. ECOSYSTEM ISSUES

5.1 MARINE MAMMAL-FISHERIES INTERACTIONS

Request (R)-1.1.5 asks the SC "*To periodically review and update available knowledge related to the understanding of interactions between marine mammals and commercially exploited marine resources*."

R-1.1.8 asks the SC "*In addressing the standing requests on ecosystem modelling and marine mammal fisheries interaction, to extend the focus to include all areas under NAMMCO jurisdiction. In the light of the distributional shifts seen under T-NASS 2007, the SC should investigate dynamic changes in spatial distribution due to ecosystem changes and functional response*".

To address these requests, updates from recent research were presented by members of the SC.

Tore Haug reported from a recent paper dealing with harp seal ecology in Norwegian high Arctic waters during autumn (Haug et al. 2021; SC/27/FI22). In September 2016, a marine ecosystem survey covered all trophic levels from phytoplankton to seals in the Arctic Ocean to the west and north of Svalbard. At the ice edge, 26 harp seals were sampled to assess whether recent environmental changes had affected their diets and body condition by comparing current results with previous investigations conducted 2–3 decades ago in the northern Barents Sea, when the ice edge was located much further south. Current results suggest that the body condition was slightly but significantly lower for one year and older seals in 2016 compared with seals sampled in the early 1990s. Furthermore, previous

findings were confirmed that polar cod and the pelagic hyperiid amphipod *Themisto libellula* still dominate the seal diet. One consequence of current ice edge localisation north of Svalbard is that the water depth underneath is now 500 m and deeper, and this probably explains the absence of bottom associated species, and the presence of species such as Atlantic cod and blue whiting as alternative species in addition to polar cod and *T. libellula*. The stable isotope data also suggest possible long-term importance in the seal diet of *T. libellula* and of low trophic level benthopelagic prey such as the squid *Gonatus fabricii* over mid-trophic level pelagic fishes, but with a strong component of small, benthopelagic fish such as blue whiting. The long-term importance of pelagic crustaceans was also suggested from the fatty acid analyses. Assessment of the abundance of prey showed that *T. libellula* was by far the most abundant prey species in the upper water layers, followed by krill (mainly *Thysanoessa inermis*), Atlantic cod and polar cod. Prey-preference analyses indicated that polar cod was the most preferred prey species for the seals.

In another study, also presented by Haug, dealing with food web structure and species trophic position, harp and ringed seals were used as a model for determining trophic position across large spatial scales in the Arctic (de la Vega et al. 2020; SC/27/FI20). Stable nitrogen isotopes ($\delta^{15}N$) in seawater nitrate ($\delta^{15}N_{NO3}$) and seal muscle amino acids ($\delta^{15}N_{AA}$) were determined to independently characterize the base of the food web and the trophic position of harp and ringed seals across the Arctic and sub-Arctic, demonstrating a direct link between $\delta^{15}N_{NO3}$ in seawater and $\delta^{15}N_{AA}$ in predators. Our results show that the spatial variation in $\delta^{15}N_{AA}$ in seal tissue reflects the $\delta^{15}N_{NO3}$ endmembers in Pacific *versus* Atlantic waters. This study provides a reference for best practice on accurate comparison of trophic position in predators and as such, provides a framework to assess the impact of environmental and human-induced changes on ecosystems at pan-Arctic scales.

Christian Lydersen also presented an update from on a ringed seal diet study from Svalbard (Bengsston et al. 2020; SC/27/FI10). This paper notes that global warming is causing Atlantification of water masses and concomitant changes in food webs in the Barents Sea region. To determine whether changes that have been documented at lower trophic levels are impacting the diet of ringed seals, gastrointestinal tracts (GITs) from 99 coastal-feeding ringed seals, collected in western Spitsbergen, Svalbard, were analysed. Polar cod (*Boreogadus saida*) dominated the diet of the ringed seals in terms of relative biomass. Blue whiting occurred in the diet in small quantities; this Atlantic fish species has not previously been documented in the ringed seals' diet. Atlantic cod had the highest *Bi* (9.2%) among Atlantic prey types. However, despite major changes in the last decade in the fish and zooplankton community in western Svalbard, and consumption of a few Atlantic prey types, the ringed seals' diet in Svalbard continues to be dominated by Arctic prey, especially polar cod.

Desportes drew attention to the work done by Sørlie et al. (2020), which studied the diet composition of harbor seals in Norwegian Skagerrak to evaluate potential competition with fisheries and whether harbour seal predation could impact the recovery of the coastal cod population. Fish length estimates showed that seals generally prefer small fish below the minimum allowed landing size. The estimated total amount of fish consumed was 315 tons per year and was dominated by non-commercial species. Annual cod consumption was an estimated 7.1 tons, representing 5% of the commercial fishery annual cod landings, to which should be added the non negligeable landing by recreational fisheries. The study therefore suggested that harbour seals do not constitute a serious direct competition with local fisheries along the Norwegian Skagerrak coast, and that predation by seals does not constitute an important factor in preventing the recovery of depleted coastal cod stocks.

Future work

Haug and Nilssen reported that a high priority part of a planned Joint Norwegian-Russian Research Program on Harp Seal Ecology is to deploy satellite transmitters on harp seals in the White Sea. In all the years 2007–2019 it was planned to do this in a joint Russian-Norwegian effort just after the moulting period (in late May), or, alternatively, in late March–early April if ice conditions are unfavorable in early May. However, either formal problems with permissions, lack of funding, or difficult ice conditions prevented tagging of seals. A new attempt was therefore made in 2020, but the

Covid-19 pandemic resulted in another cancellation. The plan is now to perform the experiment in 2021.

During the planned tagging experiment, scientists from IMR, VNIRO/PINRO and MMBI, as invited by IMR, will participate in the field work. VNIRO/PINRO will organize necessary contacts with Russian based logistics required for aircraft reconnaissance and helicopter-based live catch of seals in April-May 2021. IMR will be responsible for aircraft and helicopter rent payment, the satellite tags (already sent to Russia), including providing all the necessary technical details, as well as providing experienced personnel (if travelling is possible) and equipment for anaesthetizing seals and tag deployment. All data obtained from the tags would be available for scientists involved (i.e., from IMR, VNIRO/PINRO and MMBI). Due to expected difficult ice conditions, only beaters will be tagged. Depending on the Covid-19 situation, it may be a solution that only the Russian colleagues do the necessary field work.

Discussion

It was clarified that in the Haug et al. 2021 paper, although the seals sampled in 2016 were slightly thinner in the blubber than what had been observed in the 1990s, this difference was not dramatic. It was, however, noted that the analysis of body condition had been challenged by the presence of more young animals in the latter sample and that an increased sample size of large animals was needed to be able to draw any firm conclusions. It was noted that the potential link between prey availability, body condition and late-term abortion rates in harp seals had not been investigated.

That the stable isotope analysis had revealed the squid *Gonatus fabricii* to be an important prey species for harp seals was noted as particularly interesting. Although it is assumed that this species is relatively abundant, the SC was informed that since there is currently no effective way to measure squid abundance, specific data on this was not available.

The SC was informed that Japan was also performing research on prey consumption in cetaceans and therefore the consumption of resources by marine mammals could be an interesting area for further collaborative research between Japan and the NAMMCO member countries.

5.2 MULTI-SPECIES APPROACHES TO MANAGEMENT AND MODELLING

R-1.2.1 asks the SC *"To consider whether multispecies models for management purposes can be established for the North Atlantic ecosystems and whether such models could include the marine mammals compartment. If such models and the required data are not available then identify the knowledge lacking for such an enterprise to be beneficial to proper scientific management and suggest scientific projects which would be required for obtaining this knowledge"*.

In response to this request, updates on relevant research involving SC members were presented.

Víkingsson presented document SC/27/FI29 (Gunnlaugsson et al. 2020). This paper notes that total body mass of whales and the increase of this over the feeding season is important for estimating energy deposition in ecological modelling. However, weighing total whales is difficult, even in parts, while measurements of length, girth and blubber thickness can more easily be obtained from catches at sea. In this study, data from Icelandic and Norwegian research catches are used to create formulae for predicting total body mass and weight of energetically important tissues of common minke whales from these anatomical measurements.

In addition, seasonal changes in body mass and in the parts of muscle, blubber and visceral fat are reported. In all cases a significant increase over the season was detected, in particular for the mature animals. Pregnant females had significantly more blubber than other whales. Although the weight data are not extensive, the study provides considerable advancement because of limited previous data, and the formulae created here constitute the best available for North Atlantic minke whales.

Discussion

It was noted that the lipid content of blubber and muscle is an important aspect to take into account in addition to weight when quantifying seasonal energy deposition for ecosystem modelling.

The SC was reminded that there is an article in development, being led by Mette Skern-Mauritzen, on estimating consumption within the North Atlantic using a range of available data sources. This paper is now in an advanced stage and there is an aim that it be submitted for publication this year. Some information on the work in this paper was conveyed, but it was agreed that the results should be presented in full at next year's SC meeting after the paper had been finalised. This presentation and a discussion of the results would then contribute to the provision of a more comprehensive answer to this request.

As part of the response to R-1.2.1 given at SC26, SC members were encouraged to participate in the work of the ICES group established to provide an integrated assessment of the Greenland Sea. The SC was informed that a first meeting of this group had taken place in 2020 but that this meeting had focused on providing a summary of knowledge, with no advances towards modelling conducted as yet. It was also noted that at its last meeting in 2019, WGHARP had recommended that there be enhanced interactions with the ICES working group performing an integrated assessment o the Barents Sea (WGIBAR) and that it may therefore be possible to also provide updates from this work at SC28.

To help provide a comprehensive answer to these requests related to multi-species modelling, the SC **agreed** that the work of the in-progress article being led by Skern-Mauritzen, as well as updates from the relevant integrated assessments taking place within ICES, be presented and discussed at SC28.

5.3 OTHER ENVIRONMENTAL ISSUES

R-1.5.3, asks the SC "*To monitor the development of the Mary River Project and assess qualitatively or if possible quantitatively the likely impact and consequences on marine mammals in the area*".

In response to this request, Heide-Jørgensen provided an update on the Mary River Project.

The SC was informed that although there is an ongoing environmental impact assessment process for the second phase of the Mary River project in Canada, this assessment does not deal with issues related to transport and shipping traffic. Greenland and the Kingdom of Denmark have therefore raised the issue with Canada under ESPOO, which is an international convention with a particular focus on environmental impact assessment in a transboundary context. Canada has been asked to submit a report addressing the concerns raised under ESPOO. The Greenland Institute of Natural Resources (GINR) needs to approve the report submitted before it can be sent for a public hearing. The first submitted outline of this report was rejected as insufficient and a revised version now needs to be submitted. It was noted that the NAMMCO-JCNB JWG discussed developments in the Mary River project and as a result, recommended an expert workshop be held to review the impacts of noise disturbance on hunted populations of narwhals, belugas, walrus and seals from shipping connected to the Baffinland mine. The SC **endorsed** this recommendation under its discussion of the JWG report.

Following the update on the Mary River mine, SC members also presented summaries of recent research related to other environmental issues.

Haug reported from a recent review paper dealing with harp seals as possible monitors of change in differing ecosystems (Stenson et al. 2020; SC/27/FI21). As the focus of a commercial hunt, a large historic harp seal data set exists that can be used to quantify changes. The objective of the study was to review current status and to identify the factors that are influencing population dynamics in the different areas harp seals occupy. Although important historically, recent catches have been low and do not appear to be influencing trends in either of the two northeast Atlantic populations. Massive mortalities of White Sea/Barents Sea seals occurred during the mid-1980s due to collapses in their main prey species. Between 2004 and 2006, pup production in this population declined by 2/3 and has remained low. Body condition declined during the same period, suggesting that ecosystem changes

may have resulted in reduced reproductive rates, possibly due to reduced prey availability and/or competition with Atlantic cod. The most recent estimate of pup production in the Greenland Sea also suggests a possible decline during a period of reduced hunting although the trend in this population is unclear. Pupping concentrations are closer to the Greenland coast due to the reduction in ice in the traditional area and increased drift may result in young being displaced from their traditional feeding grounds leading to increased mortality. Reduced ice extent and thickness has resulted in major mortality of young in the Northwest Atlantic population in some years. After a period of increase, the population remained relatively stable between 1996 and 2013 due to increased hunting, multiple years with increased ice-related mortality of young seals, and lower reproductive rates. With a reduction in harvest and improved survival of young, the population appears to be increasing although extremely large interannual variations in body condition and fecundity have been observed which were found to be influenced by variations in capelin biomass and ice conditions. Each of these populations has been impacted differently by changes in their ecosystems and hunting practices. Identifying the factors influencing these three populations, a better understanding of how species may respond to changes that are occurring in their ecosystems is gained.

Skern-Mauritzen provided information on the projects BarentsRISK and CoastRISK at the Norwegian Institute of Marine Research (IMR), which are investigating the development of human activities across sectors, and associated stressors, in the Barents Sea and along the Norwegian coast. The development of these activities and stressors will be assessed relative to risk from cumulative impacts to marine mammals and other ecosystem components. A similar EU project, Mission Atlantic, where IMR is heavily involved, is also working towards the same goals on an all-Atlantic scale. Among the more specific products focused on now is a review of impact from anthropogenic stressors on marine mammals and other functional groups. Also, the projects will use a recently developed model for estimating noise (the JOMOPANS project in the North Sea) together with regional ship traffic data and seismic data to investigate the development of marine noise in the coastal regions and the Barents Sea. However, in this work the group has experienced that there are no seismic shooting logs available from the Norwegian sectors. The Norwegian Petroleum Directorate provides information on which time period and geographic region the survey is accepted for. However, a detailed shooting log, with time and position for each seismic shot, as well as information on energy level, is required for sound estimation. Delivering such shooting logs are compulsory for seismic companies operating in EU waters.

The SC recognises that marine noise is a widespread and increasing anthropogenic stressor that can impact marine mammals. They therefore **recommended** that all NAMMCO member countries ensure the availability of relevant information from seismic surveys for proper sound estimation to meet research and management needs. At SC26, it was also agreed that all WGs include other anthropogenic impacts as an agenda item.

6. PINNIPED STOCKS

6.1 HARP SEALS

6.1.1 Updates

No research or management updates were presented for this species at SC27.

6.1.2 Status of active requests (R-2.1.4, R-2.1.10)

R-2.1.4 *…to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

R-2.1.10 *To provide advice on the total allowable catches for the management of harp seals.*

The work to answer both requests is carried out by WGHARP and will therefore be updated again during the next meeting of this working group, which is currently planned for autumn 2023. Prior to

this, improvements and advances will be made through the planned benchmark meeting in 2022 (with preparatory work throughout 2021) and the review of harvest control rules.

6.2 HOODED SEALS

6.2.1 Updates

No research or management updates were presented for this species at SC27.

6.2.2 Status of active requests (R-2.1.4, R-2.1.9)

R-2.1.4 *…to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

The work to answer this request is carried out by WGHARP and will therefore be updated again during the next meeting of the group, which is currently planned for autumn 2023. Prior to this, improvements and advances will be made through the planned benchmark meeting in 2022 (with preparatory work throughout 2021) and a review of the current harvest control rules (spring 2023).

R-2.1.9 *To investigate possible reasons for the apparent decline of Greenland Sea stock of hooded seals…*

With the information available to date, neither WGHARP nor the SC is able to answer this question.

6.3 RINGED SEALS

6.3.1 Updates

The SC noted the NAMMCO Council request from 2020 that a WG meeting be carried out to assess the status of this species and that this not be delayed beyond 2022. However, it also expressed concern that there may be insufficient information to carry out a full assessment.

Aqqalu Rosing-Asvid informed the SC that the tagging studies that have been conducted over several years in Greenland will continue this year and once complete, will create a 10-year time series of information. The SC was reminded that a small group of ringed seals (a little more than 2,000 animals) that are quite different from all other ringed seals (including genetically) had been observed in Greenland and that the research on this unique group is now being written up for publication in an academic article.

The wish of the SAMBR/CAFF expert to perform a genetic review of ringed and bearded seals in cooperation with NAMMCO was also noted.

6.3.2 Status of active requests (R-2.3.1, R-2.3.3)

R-2.3.1 *To advise on stock identity of ringed seals for management purposes and to assess abundance in each stock area, long-term effects on stocks by present removals in each stock area, effects of recent environmental changes (i.e., disturbance, pollution) and changes in the food supply, and interactions with other marine living resources.*

R-2.3.3 *To convene a working group in 2022 with the aim of conducting a thorough review of the existing data and to go ahead with the assessment of stocks for which it was possible. If the data required for a full assessment of (some of) the stocks were not available, the WGs and the SC should identify, and prioritise, which specific data essential to their assessments are still needed.*

The SC **agreed** that as a first step, an overview of the information required and available to perform an assessment should be generated, together with a review of the literature currently available and particularly that published since the last review was performed in 2010. This information will then be considered in the planning for a working group meeting no later than 2022. The SC was informed that

a new intern would start at NAMMCO in February 2021 and would be tasked with producing a review of the information available to help inform the WG meeting.

6.4 GREY SEALS

6.4.1 Updates

Updates on this species were provided in the CSWG Report, see section 3.3.

6.4.2 Status of active requests (R-2.4.2)

R-2.4.2 *To provide a new assessment of grey seal stocks throughout the North Atlantic.*

This will be done through the next meeting of the CSWG, which is currently scheduled for 2022.

6.5 HARBOUR SEALS

6.5.1 Updates

Updates on this species were provided in the CSWG Report, see section 3.3.

6.5.2 Status of active requests (R-2.5.2)

R-2.5.2 *To conduct a formal assessment of the status of harbour seals around Iceland and Norway as soon as feasible.*

This will be done through the next meeting of the CSWG, which is currently scheduled for 2022.

6.6 BEARDED SEALS

6.6.1 Updates

The SC noted the NAMMCO Council request from 2020 that a WG meeting be carried out to assess the status of this species and that this not be delayed beyond 2022.

It was also noted that Kovacs et al. (2020; SC/27/FI11) presented recent research on bearded seals in Svalbard.

6.6.2 Status of active requests (2.7.1)

R-2.7.1: *To convene a working group in 2022 with the aim of conducting a thorough review of the existing data and to go ahead with the assessment of stocks for which it was possible. If the data required for a full assessment of (some of) the stocks were not available, the WGs and the SC should identify, and prioritise, which specific data essential to their assessments are still needed.*

The SC **agreed** that as a first step, an overview of the information required and available to perform an assessment should be generated, together with a review of the literature currently available and particularly that published since the last review was performed in 2010. This information will then be considered in the planning for a working group meeting no later than 2022. The SC was informed that a new intern would start at NAMMCO in February 2021 and would be tasked with producing a review of the information available to help inform the WG meeting.

6.7 WALRUS

6.7.1 Updates

No research or management updates were presented for this species at SC27.

6.7.2 Status of active requests (R-2.6.3, R-3.4.9, R-2.6.8)

R-2.6.3 *Provide advice of the effects of human disturbance, including fishing and shipping activities, tourism, hydrocarbon exploration and mineral extractions on the distribution, behaviour and conservation status of walrus in Greenland.*

This request was partly answered by the walrus working group (WWG) in 2018. There is, however, also an intention to further address this request through the new recommendation made by the JWG and endorsed by the SC that a workshop to assess disturbance from the Baffinland/Mary River mine project be held and consider impacts on narwhals, beluga and walrus.

7. CETACEAN STOCKS

The SC reiterated its appreciation that all the abundance estimates of species covered by the NASS series that could be generated have now been completed and published, rounding up 30 years of survey efforts.

7.1 FIN WHALE

7.1.1 Updates

No research or management updates were presented for this species at SC27.

7.1.2 Status of active requests (R-1.7.12)

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

At SC24 and SC25, the SC advised that the SLAs developed within the IWC provided the best scientific basis for advice on sustainable takes of large whales in Greenland. Following a request from the MCC, SC26 also elaborated on how these SLAs can be applied without using needs statements. The SC therefore **reiterated its recommendation** that SLAs be used to provide advice on sustainable takes of large baleen whales in West Greenland waters and thereby considered this request to be answered.

7.2 HUMPBACK WHALE

7.2.1 Updates

An update on North Atlantic humpback whale satellite tracking was provided by Heide-Jørgensen.

A meeting was held in Barcelona on 10 December 2019 to discuss the possibility of sharing tagging data from humpback whales of the Atlantic. All participants agreed to share tagging and metadata. The final objective will be the publication of an overview of the distribution, hotspots (location, connectivity and seasonality) and migration routes of humpback whales in the North Atlantic.

The following scientists were present at the meeting: Mads Peter Heide-Jørgensen (chairman), Steve Ferguson, Audun Rikardsen, Lisa Kettermer, Martin Biuw, Jooke Robbins, Marie-Anne Blanchet (rapporteur), Kyle Lefort, Jack Lawson and Tenna Boye. The following scientists, that have agreed to share data from their tracking studies, were not present at the meeting: Alexander Zerbini, Kirstin Laidre, Gísli Víkingsson, Michel Vély, Nils Øien and Malene Simon.

The following course of actions was decided at the meeting:

* Leads of the paper: Lisa Kettemer and Kyle Lefort

* Tracking data and metadata (including biological information): to be hosted privately in MoveBank for storage and to allow participants to look at the combined data set.

The tracking data should be in a raw form extracted from Argos files. The information provided should ideally include: tag type, tag placement, tag programming, sex, size, date, in order to produce a summary table including animal and tag metadata, tracking duration and coverage period. It was

agreed that metadata and raw tracking data should be forwarded to Lisa Kettemer by 1 February 2020. In January 2021 all the data had been compiled and analyses will be conducted in spring 2021.

NAMMCO has showed interest in funding a meeting that could facilitate the analysis and presentation of tracking data from the North Atlantic humpback whales. No decisions were made about this and it was agreed that the need for a meeting would be evaluated when an overview of the initial analyses is available.

7.2.2 Status of active requests (R-1.7.12, R-3.2.4)

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

R-3.2.4 *To conduct a formal assessment following the completion of the T-NASS. In addition to investigate the relationship between the humpback whales summering in West Greenland and other areas and incorporate this knowledge into their estimate of sustainable yields of West Greenland humpback whales.*

SC24 provided advice on sustainable yields for humpback whales in West Greenland based on the SLA used within the IWC. SC25 reiterated its advice that SLAs provided the most robust advice on sustainable removals for all large baleen whales in West Greenland, while SC26 provided additional information on the method and a clarification of how SLAs can be used without a needs statement. At CN27, the MCC agreed that further work to address request R-3.2.4 was no longer a priority.

7.3 COMMON MINKE WHALE

7.3.1 Updates

No research or management updates were presented for this species at SC27.

7.3.2 Status of active requests (R-1.7.12)

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

The SC **reiterated** its advice from SC24 and SC25 that SLAs are the best method to provide advice on sustainable removals for all large baleen whales in West Greenland waters and thereby considers this request answered.

7.4 BELUGA

7.4.1 Updates

Updates for this species were provided in the report of the NAMMCO-JCNB Joint Working Group, which is presented under section 3.2.

7.4.2 Status of active requests (R-3.4.11)

R-3.4.11 *To update the assessment of both narwhal and beluga, noting that new data warrant such an exercise.*

This work is done within the context of the NAMMCO-JCNB JWG and was updated during the 2020 meeting (see section 3.2 for the report from this meeting, including the updated assessment and advice).

7.5 NARWHAL

7.5.1 Updates

In addition to the information that was provided on narwhals from the 2020 meeting of the NAMMCO-JCNB JWG (see section 3.2), the SC also received a specific update on narwhals in East Greenland from Heide-Jørgensen.

The Ad hoc Working Group on Narwhal in East Greenland (NEGWG) last met in September 2019 and the report from that WG meeting was presented at SC26. However, as noted in the opening remarks from the Chair, the full SC26 report has not yet been presented to Management Committee and Council meetings. A second meeting of the NEGWG is now planned for September 2021.

The recommendation from the SC meeting in 2019 was that harvest in all three management units in southeast Greenland (Ittoqqortoormiit, Kangerlussuaq and Tasiilaq) should be reduced to zero, until a new abundance estimate becomes available. The SC was informed through document SC/27/18 that quotas of 40, 0 and 10 narwhals (total of 50) were set for the Ittoqqortoormiit, Kangerlussuaq and Tasiilaq management units in 2020. A gradual reduction of East Greenland quotas for narwhals is planned to continue through 2023, when the cumulated catches in all 3 management units would be 20 whales.

From the 2020 quota, 8 and 6 whales were subtracted from the Ittoqqortoormiit and Tasiilaq quotas, respectively, to account for quotas that were exceeded in 2019. An extra quota of 8 was given to Tasiilaq in June 2020, leaving an effective quota for this management unit of 12 whales for 2020.

A total of 36 narwhals were reported landed in Ittoqqortoormiit in 2020, of which 21 were taken outside the Scoresby Sound in the fjords along the northern part of the Blosseville Coast in August, and the rest were taken inside Scoresby Sound in September. The field station in Hjørnedal was manned from mid-August through early September, but no whales were live-captured (for tagging) or caught by hunters in Hjørnedal in 2020.

No whales were reported to be taken in the Kangerlussuaq management unit in 2020. In Tasiilaq the reported catches in 2020 was 16 and they were all taken in one group on 25 April.

Discussion

The SC acknowledged that managers in Greenland have responded to the advice from 2018 (but not the 2019 advice of zero catch) by planning a gradual reduction in quota over time. However, the SC emphasized that it viewed this response as insufficient given the critical nature of the situation, where the hunted stocks are very small and at serious risk of local extirpation. The SC therefore **reiterated** its concern for the status of narwhals in all three management units in East Greenland and the high risk of extirpation of the stocks if harvest at any level continues.

The SC **reiterated** the suggestion from 2020, that the Chair of the NEGWG (Roderick Hobbs) should be invited to present, online or face-to-face, the WG report at the next meeting of the MCC. The SC also **agreed** that a new meeting of the NEGWG be scheduled for 2021 as planned and urged strong support and attendance at this meeting from SC members.

7.5.2 Status of active requests (R-3.4.9, R-3.4.11)

R-3.4.11 *To update the assessment of both narwhal and beluga, noting that new data warrant such an exercise.*

This work is done within the context of the NAMMCO-JCNB JWG. At the 2020 meeting of the JWG, a quantitative sub-group was established to work intersessionally to deliver the information necessary to update the assessment. An updated assessment and advice will be provided at the next JWG meeting, which is currently scheduled to take place in the autumn of 2021.

7.6 SEI WHALE

7.6.1 Updates

No research or management updates were presented for this species at SC27.

7.6.2 Status of active requests (R-3.5.3 amended, R-1.7.12)

R-3.5.3 (amended) *To assess the status of sei whales in West Greenland waters and the Central North Atlantic and provide minimum estimates of sustainable yield.*

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

The SC noted that there is still insufficient data to answer these requests.

7.7 BOTTLENOSE WHALE

7.7.1 Updates

The Working Group on Abundance Estimates (AEWG) has the general task of generating estimates of abundance and trends as soon as possible after a survey is completed, with the primary target species (fin, minke and pilot whales) as a first priority, and other species as a secondary priority. The last meeting of the AEWG was in 2019. At that time, the AEWG considered its task to be largely complete, as abundance estimates had been produced for almost all species with a sufficient number of sightings from the 2015 and earlier NASS. However, unlike earlier survey series by Norway, the recent (2014-2018) series did realise sufficient sightings to estimate the abundance of Northern bottlenose whales. This new estimate was included in a paper that has now been peer-reviewed and published in the NAMMCO Scientific Publications series (Leonard & Øien, 2020). It was noted that these estimates had not been considered by the AEWG as they were not available at the last meeting of the WG in 2019. Rather than convening a new meeting of the AEWG though, it was considered more efficient to provide the information directly to the SC for consideration at SC27. The abundance estimate and the method of its calculation was described in document SC/27/20, which was presented at the meeting by Nils Øien.

Within the most recent survey cycle, enough sightings were recorded to provide an estimate of abundance for Northern bottlenose whales. The sightings were made in the Jan Mayen survey block and an adjacent Norwegian Sea stratum north of Faroe Islands, well in accordance with the impression of a distribution associated with the mid-Atlantic ridge as experienced from earlier surveys. The Norwegian surveys are double platform surveys conducted in passing mode and thus the data have been analysed using mark-recapture distance sampling techniques. A detection function was fitted to the 27 sightings recorded and resulted in a total corrected estimate of 7,800 bottlenose whales (95% CI: 4,373 – 13,913) (Table 2).

Table 2. Abundance estimates for bottlenose whales from the 2014-2018 Norwegian shipboard mosaic surveys. S/A, shipboard (s) or aerial survey (A); P, Perception bias; A, availability bias.

Survey				Uncorrected Abundance Estimate (UAE)			Corrected Abundance Estimate (CAE)			Bias correction		Reference
Area	Name	Year	Mode	UAE	CV	95% CI	CAE	CV	95% CI	P	A	
NO mosaïc	NILS	2014–2018	IO				7,800	0,20	4,373 – 13,913	1	0	Leonard & Øien 2020

The corrected abundance estimate presented for northern bottlenose whales was **endorsed** for use in assessment and advice. However, the SC also **recommended** that a single estimate for the whole NAMMCO management area be generated through a re-stratification and recalculation.

7.7.2 Status of active requests (none)

7.8 KILLER WHALE

7.8.1 Updates

The AEWG considered its task to be largely complete following its last meeting in 2019, as abundance estimates had been produced for almost all species which had a sufficient number of sightings from the 2015 and earlier NASS. However, subsequent to that meeting, SC26 recommended that estimates of killer whale abundance be produced from the recent Icelandic/Faroese NASS, and from earlier ones by combining surveys. Pike was tasked with doing this, and the resulting paper was peer reviewed and published (Pike et al., 2020). These estimates have not been reviewed by the AEWG, but they have been peer reviewed and published. As convening a meeting of the AEWG for this purpose would have been inefficient, it was decided to have the SC consider the estimates directly for possible endorsement.

Chair of the NAMMCO AEWG, Daniel Pike, presented new abundance estimates for killer whales (*Orcinus orca*) (available in document SC/27/20).

Abundance from the 1987 NASS was previously estimated by Gunnlaugsson & Sigurjónsson (1990), however they used analytical methods that would be considered non-standard today. Foote et al. (2007) provided uncorrected estimates for surveys up to 2001 inclusive as a document to the Scientific Committee of the IWC, however they provided no information on detection function modelling or other analytical details, and the estimates were not published. No estimates have been previously calculated from the 2007 or 2015 surveys.

Killer whales are relatively rarely sighted in the survey area, with sighting numbers ranging from 5 to 45 in the 6 surveys conducted between 1987 and 2015 (Figure 4). The authors considered 30 sightings to be minimum for a robust detection function model. As surveys up to 1995 had fewer than 30 detections, sightings from these 3 surveys were pooled to derive a single detection function, while testing survey identity as a possible scale covariate. Similarly, the dedicated portion of the 2007 survey realized only 9 detections. Therefore, these were pooled with those from the extension survey that year, which had 26 detections. Uncorrected estimates were produced for all surveys. Perception bias corrected estimates were produced for 2001 and 2015 surveys, but not for the 2007 survey for which only 1 duplicate sighting was available.

Total estimates are given in Table 3, with modelling details stratum-level results provided in the publication. Because of the low numbers of sightings and high encounter rate variance, estimate precision was low with CVs ranging from 0.37 to 0.63. Uncorrected abundance in the NASS core area ranged from a low of 4,736 (95% CI: 1,842–12,176) in 1995 to a maximum of 15,142 (95% CI: 6,003–38,190) in 2001. Corrected abundance was highest in 2015 with a total estimate of 30,540 (95% CI: 8,316–112,120). Taking account of the overlap between the Norwegian and Icelandic survey areas, we estimated a total of 22,100 (95% CI: 15,282–32,023) in the Central and Northeast Atlantic in 2015.

Estimates are not corrected for availability or possible responsive movement, however availability bias is expected to be slight. The low precision of the estimates precludes a meaningful analysis of trends in abundance. Nevertheless, the surveys indicate that killer whales number in the low tens of thousands in the central and northeast North Atlantic.

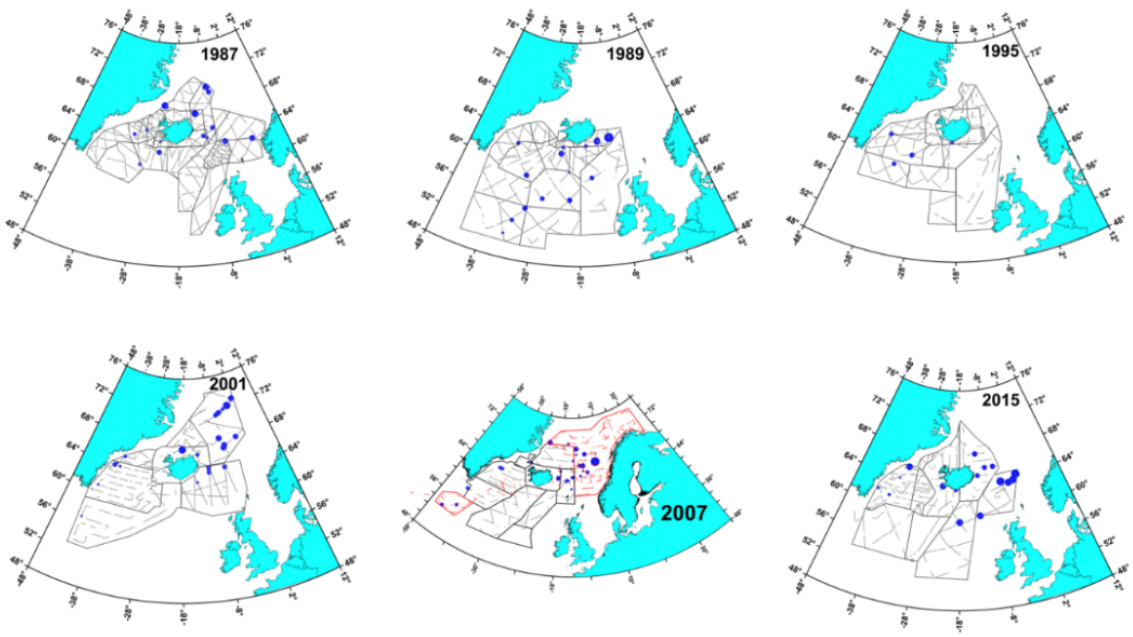

Figure 5. Realized survey effort (BSS<5) and sightings of killer whales in Icelandic/Faroese NASS ship surveys. 2007 extension strata shown in red. Symbol size varies with group size from 1 to 40. In all surveys, killer whales were sighted throughout the survey area, but most commonly to the east and northeast of Iceland.

Table 3. Abundance estimates for killer whales from the Icelandic and Faroese NASS shipboard surveys series. S/A, shipboard (s) or aerial survey (A); P, Perception bias; A, availability bias (from Pike 2020)

Survey				Uncorrected Abundance Estimate (UAE)			Corrected Abundance Estimate (CAE)			Bias correction	
Area	**Name**	**Year**	**Mode**	**UAE**	**CV**	**95% CI**	**CAE**	**CV**	**95% CI**	**P**	**A**
IS + FR + NO	NASS + NILS	2015	IO				22,100	0.28	15,282–32,023	1	0
IS + FR	NASS	2015	IO	14,611	0.55	4,055–52,773	30,540	0.63	8,316–112,120	1	0
IS + FR + Extension	TNASS	2007	BT	57,460	0.50	22,385–147,494					
IS + FR	NASS	2001	BT	15,460	0.47	6,003–38,190	20,345	0.63	6,317–65,523	1	0
	NASS	1995	SP/BT	4,736	0.48	1,842–12,176					
	NASS	1989	SP	20,136	0.37	4,960–21,456					
	NASS	1987	SP	8,899	0.46	3,621–21,870					

The SC **endorsed** all the estimates presented. Due to the wide confidence intervals on the 2015 estimate for Iceland and the Faroe Islands, it was not considered reliable for use in assessment and advice. The SC therefore **agreed** that for 2015, the estimate that also contained the Norwegian survey component was the more robust and accepted this estimate for use in assessment and advice.

The SC was also given an update that last year, the annual Russian-Norwegian ecosystem survey observed killer whales very far to the north in the Barents Sea (78˚46’ N, 45˚9’ E). A group of 6 individuals was observed in association with white whales.

7.8.2 Status of active requests (none)

7.9 PILOT WHALE

7.9.1 Updates

An update was presented by Mikkelsen that abundance estimates for the Central North Atlantic from the 2007 and 2015 Icelandic and Faroese shipboard surveys were now published (Pike et al. 2020b, Pike et al. 2019a), as well as a paper examining trends in relative abundance in the Northeast Atlantic (Pike et al. 2019b). It was also noted that catches are updated annually, with an average of around 600 animals taken per year. The SC was informed that samples for updating information on life history have been collected for some years and that analytical work is planned for 2021. A large number of teeth have been collected and are available for aging, but these have not been processed as yet and this may take some time. Ovaries have also been collected and stored over several years and analysis of these will be performed in parallel with the aging work. Tracking to assess movements and distribution and the possible recruitment area for pilot whales hunted in the Faroes has been ongoing and in total, tracking data for 10 pods has now been obtained. The intention is that the results of this tracking data will be reviewed prior to the planned WG meeting.

Hansen informed the SC that there is an opportunistic harvest of pilot whales in Greenland and catch statistics are available, as well as two abundance estimates from the T-NASS surveys. It was noted that there is an increasing hunt in east Greenland but that no biological samples are collected from the Greenlandic hunt.

7.9.2 Status of active requests (R-1.7.11, R-3.8.6)

R-3.8.6 *To continue work to complete a full assessment of pilot whales in the North Atlantic and provide advice on the sustainability of catches, as soon as necessary further information becomes available, with particular emphasis on the Faroese area and East and West Greenland. In the short term, the SC was requested to provide a general indication of the level of abundance of pilot whales required to sustain an annual catch equivalent to the annual average of the Faroese catch in the years since 1997.*

This will be done through a planned working group meeting, which the SC **agreed** to reschedule for 2022 on the basis of the updates received.

7.10 DOLPHINS

7.10.1 Updates

During SC26, it was decided that all NAMMCO member countries should provide a summary of the information available to provide an assessment of white-sided, white-beaked and bottlenose dolphin species.

Mikkelsen presented working document SC/27/22 with the information available from the Faroe Islands. In the period 2001–2009, biological material from white-sided dolphins was collected from the drive hunt, for investigating sex, age, reproduction, diet, and genetics. The current status is that the material has been analysed, and results are available on sex and age composition, life history, feeding habit and genetics. Also, abundance estimates of white-sided dolphins for the Icelandic and Faroese components of T-NASS 2007 and NASS 2015 are now available.

Iceland informed that SC that abundance estimates for dolphin species in the Icelandic-Faroese area since the 1986 surveys, are now available, at least for some sub areas, and that a few biological samples had been collected from strandings. Unpublished data was also available, as was some information on by-catch. The SC was informed that in Greenland, two abundance estimates were available as well as catch statistics. It was told that there are now two different names for white-sided and white-beaked dolphins in Greenland, which addresses a previous request from the SC and should help future catch statistics be presented on a species basis. It has also noted that a dedicated sampling program had been proposed for white-beaked dolphins in East Greenland. For information document SC/27/FI27 provided abundance estimates for dolphin species in Norway.

Although the SC saw that it may be possible to perform an assessment for white-sided dolphins in the Faroe Islands, there was insufficient information to carry out a full assessment on other species and other areas at this time. The possibility to perform limited forms of assessment (e.g., calculating potential biological removal levels) for areas like Greenland where there is a direct catch was discussed. The SC **agreed** that the information available to fully answer this request would be reconsidered at SC28.

7.10.2 Status of active requests (R-3.9.6)

R-3.9.6 *The SC was asked to carry out assessments of these species but to date insufficient information has been available on stock delineation, distribution, abundance and biological parameters to initiate the work…The Committee endorsed the plan of the SC to proceed with the assessments once the above-mentioned studies have been completed.*

The SC received an update on the information available to answer this request at this meeting and noted that the data necessary to perform a full assessment is still lacking. The work on dolphin species was encouraged to continue and a further update on the information available will be provided at SC28.

7.11 HARBOUR PORPOISE

7.11.1 Updates

In 2016 and 2017, a program using by-caught harbour porpoises for scientific sampling was organised in Norway. Haug reported from 3 papers based on this material (SC/27/FI23, FI24 and FI25).

Quintela et al. (2020) used tissues from 134 porpoises to assess the genetic population structure of the species by SNP-genotyping at 78 loci. The results of genetic clustering obtained for these individuals failed to identify more than one genetic group. Likewise, the individually-based F did not meet an Isolation-by-Distance pattern, thus supporting the conclusion that harbour porpoise in Norway probably belong to a single genetic group or population.

Phtalate is a synthetic organic chemical that impacts the flexibility and elasticity of plastics (plasticiser). Rian et al. (2020) did a baseline study (based on liver samples) of phthalate metabolites in porpoises and concluded that levels were higher in porpoises taken in waters adjacent to areas with higher human activity and populations. For some reason, the occurrence profile of phtalate metabolites in porpoise liver demonstrated some similarities with human urine. The authors suggested that harbour porpoises can be potentially be used as tracers for plasticisers in the marine environment.

Dietz et al. (2020) undertook a risk assessment of the effects of mercury in a various of marine taxa, also including harbour porpoises. The focus was on the Baltic Sea, while comparisons with other areas were done when samples were available. Mercury concentrations in muscle of porpoises from the Baltic were classified in the no risk category. All porpoises from the Norwegian coast were in the no risk category.

The SC thanked Haug for the update from this research program in Norway.

The SC also noted that the advice endorsed at SC26 that catch statistics for harbour porpoise in West Greenland be validated to address the identified issue of significant underreporting and that there be an annual landed catch of no more than 2,629 animals had not yet been implemented. It acknowledged that this advice had not yet been reviewed by the MCC as they did not have a meeting in 2020.

7.11.2 Status of active requests (R-3.10.1)

R-3.10.1 *(Renewed) The Council noted that the harbour porpoise is common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the species throughout its range. The Council therefore requested the SC to perform such*

an assessment, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals.

The SC noted that the assessment for West Greenland had been completed. The HPWG had provided recommendations regarding the data needed to conduct assessments in other areas and given advice on how to obtain reliable information. Harbour porpoise assessments for Norway and Iceland are now tentatively scheduled for 2022, with final confirmation pending the availability of the necessary data.

R-3.10.1 *(Renewed) The Management Committee recommends that total removal estimates are made for all areas, and that abundance estimates from the 2007 survey in Iceland and the 2010 survey in the Faroe Islands are available before a WG meeting. (NAMMCO 19).*

The BYCWG has progressed on its delivery of by-catch estimates of harbour porpoises in Iceland and Norway. The SC has also previously recommended that better reporting of harbour porpoise catch be implemented in Greenland, with effort dedicated to eliminating underreporting. Abundance estimates from the 2007 survey in Iceland and the 2010 survey in the Faroe Islands have now been completed and published (Gilles et al. 2020).

7.12 SPERM WHALE

7.12.1 Updates

Lydersen presented from a new tagging study of sperm whales from the west-coast of Svalbard. Eight sperm whales were tagged from a helicopter with tags that provide information on location and diving.

7.12.2 Status of active requests (none)

7.13 BOWHEAD WHALE

7.13.1 Updates

Heide-Jørgensen presented document SC/27/19 with an update on bowhead whales.

The East Greenland – Svalbard – Barents Sea (EGSB) stock of bowhead whales was among the first to be exploited commercially and the first whale population to be depleted. The exploitation was focused on the west coast of Svalbard and the Greenland Sea and it is estimated that fewer than 1000 bowhead whales were left in this stock when the whaling stopped in 1911.

The first sign that the EGSB stock is recovering came from a report from 2005 of an increasing number of sightings from the East Greenland coast. More quantitative evidence that the stock is increasing came from an aerial survey in 2009 of the Northeast Water that generated a fully corrected estimate of 102 whales (95% CI: 32−329). Repeated surveys in the Northeast Water in East Greenland 2017 and 2018 gave new abundance estimates of 301 whales (95% CI: 127−769) and 318 whales (95% CI: 110−956). All three surveys indicate that the Northeast Water in both spring and summer have an abundance of bowhead whales that is in the low hundreds and this is in contrast to observations from marine studies in the Northeast Water conducted from *r/v Polar Stern* during the summers of 1991, 1992, and 1993, where no bowhead whales were seen.

In the Greenland Sea the last two whaling vessels observed 27 whales in 1888 and only 16 in 1907.

Opportunistic sightings from a cruise ship in the Greenland Sea that operated in the same area as the whaling vessels provided a record of 85 sightings involving 220−227 bowhead whales in 2015 and 2018 with particularly large aggregations of 84 and 104−110 whales observed in June 2015 and in May-June 2018, respectively. The sightings in the Greenland Sea as well as the tracking of whales indicate that the bowhead whales are still using the same habitats as where the whalers found them >100 years ago.

North of Svalbard, a survey in 2015 provided a fully corrected abundance of 343 whales (95% CI: 136–862) and around Frantz Josef Land whales have been observed year-round and observations during the last decade suggest that this area may be occupied by at least a hundred bowhead whales.

It is at present not possible to determine if the increasing abundance is due to >100 years of protection of the EGSB stock or if it is supported by immigration from the large and growing Bering-Chukchi-Beaufort Sea stock. It is well documented that the East Canada–West Greenland stock, that was depleted in mid 1800s, showed a sudden increase after 2000 after a century with very few sightings. It has not been resolved if the rapid increase was due to a population recovery or if immigration contributed.

Nevertheless, the new and surprisingly large abundance estimates from the past decade covering parts of the range of the EGSB stock show that a healthy stock of at least several hundred bowhead whales is thriving between East Greenland and Franz Josef Land.

The SC **welcomed** this update and the positive news regarding this stock of bowhead whales.

7.13.2 Status of active requests (none)

7.14 BLUE WHALE

7.14.1 Updates

No research or management updates were presented for this species at SC27.

7.14.2 Status of active requests (none)

8. SURVEYS

At SC26 in 2019, SC members from each member country were nominated to join a sub-group to plan the next coordinated survey within the series of North Atlantic Sightings Surveys (NASS). This included Rikke Hansen from Greenland (also nominated as Chair of the planning sub-group), Bjarni Mikkelsen from the Faroe Islands, Nils Øien from Norway, and Gísli Víkingsson from Iceland. Hansen presented the SC with an overview of planning progress to date. She noted that two years ago, it was decided that another large coordinated survey should be planned and that the most appropriate year for this was 2023. This decision was presented and endorsed at the 27th meeting of the NAMMCO Council and Management Committees in 2019. Hansen informed the group that an online meeting of the planning sub-group had been held in September 2020, noting that Norway had been unable to attend. It was suggested by those present at that meeting that although 2023 was still an appropriate year, it could also potentially be moved forward to 2024 or 2025 if that was necessary for coordinating the survey with the plans for the Norwegian mosaic survey cycle.

The SC was informed that Norway did not currently plan to survey the areas of relevance to Iceland and the Faroe Islands until 2025. In the Norwegian survey cycle, the intention is to cover the North Sea in 2023 and the Svalbard area in 2024. It was noted that there may be some flexibility to cover adjacent areas in the 2024 survey plans.

Greenland informed the group that it would aim to cover the same survey area as that covered in 2015. It noted that shifting the survey to 2024 would better accommodate changes in monitoring plans that have been required following the disruptions associated with the corona virus.

Iceland informed the group that it had not yet received information from the Ministry regarding the acceptability of different options on the survey timing. However, based on the current rules of the IWC, having the next survey in 2024 seemed to allow sufficient time to generate abundance estimates without incurring any negative consequences for quota allocation. It was also noted that although

there are currently no confirmed plans for a specific harbour porpoise survey, this is still viewed as necessary.

The Faroe Islands stated that they had some flexibility regarding timing and supported the importance of finding a common year to achieve a coordinated effort and coverage.

The SC **agreed** that having a coordinated survey would enhance the possibility of obtaining national funding. It was noted that in the past, additional funding from member countries had been received by NAMMCO based on a request from the survey planning group. At the time, this group liaised directly with the NAMMCO Finance and Administration Committee (FAC). It was emphasised that this was an effective and valuable way to secure sufficient funding to ensure a robust survey.

The SC **agreed** that 2024 was now the most appropriate year for a coordinated survey. The Chair of the planning sub-group agreed to draft a proposal outlining the plan for a coordinated survey. This document will be circulated to the SC members for their review by correspondence, with an aim to present this proposal at the next Council meeting in March 2021.

9. FUTURE WORK PLANS

The SC highlighted the technical difficulties with generating formal assessments for very small populations, and that the high risks associated with continued exploitation of populations that are too small to be properly assessed. The SC therefore **reiterated its recommendation from 2019** that the NAMMCO Management Committees support the development of a standard or principle-based approach for how to manage small and/or depleted stocks within NAMMCO. The SC also suggested that this should be topic on the agenda for SC28 in 2022 as a way to begin the discussion and advance the development of such an approach.

The workplan for the next three years was reviewed and amended based on the updates and information presented at this meeting. It was particularly noted that the coastal seals working group meeting was moved from 2021 to 2022 to allow for the completion of the survey cycle in Norway and the analysis of its results; the Pilot whale working group meeting was moved from 2021 to 2022 to allow for the analysis of biological samples to be completed; it was important to have a meeting of the by-catch working group prior to those on coastal seals and harbour porpoise so that endorsed estimates of by-catch may be included in the assessments performed during those meetings. The agreed schedule is presented below.

In addition to the plans for working group meetings, it was noted that the SC had endorsed recommendations from the JWG to regarding four different workshops. In considering these workshops within the context of its workplan, the SC **agreed** the following courses of action. For the proposed workshop on disturbance related to the Baffinland mine, the JWG would be asked to provide an elaborated description that included terms of reference for the workshop, aims and target audience. For the workshop to exchange knowledge on effective tagging practices for belugas, the JWG would be asked to include this topic within the scope of their next meeting and the SC emphasised that if this knowledge exchange was conducted online, it would be more likely that expertise from the tagging efforts in Svalbard could be included. Regarding the proposed workshop on population growth in small stocks of narwhals and belugas, it was noted that this was an issue of broader interest within NAMMCO and that as noted above, both the Joint Management Committee and the SC would discuss the topic in more depth at their next meeting. For the recommended workshop on climate change and how this can be incorporated in population assessments and modelling, the SC noted that this topic also had relevance beyond narwhal and beluga species and would, for example, be included in the discussions and work around the benchmark process for harp and hooded seals. It was also noted that there was a plan to consider climate change impacts within the agenda of the next meeting of the JWG.

2021	2022	2023
Working Groups: - Narwhal in East Greenland - NAMMCO-JCNB JWG on Narwhal and Beluga - By-catch **Other:** - NASS Planning (online) - Harp & Hooded Seals Benchmark kickoff (online)	**Working Groups:** - Bearded Seal - Ringed Seal - Harbour Porpoise - Coastal Seals - Pilot Whale **Other:** - Harp & Hooded Seals Benchmark Meeting	**Working Groups:** - Harp & Hooded Seals - Dolphins

Following agreement on the workplan, the budget for 2021 and 2022 were reviewed and amended as appropriate to reflect the revised plan.

10. ANY OTHER BUSINESS

Given the opportunities afforded by online meetings, it was suggested that it may be possible and valuable to have WG Chairs participate and present their work at the next Council Meeting. It was noted that this would require agreement from the Chairs of the Management Committees and that given that 2021 would represent the first time a NAMMCO Council meeting would be held online, it may not be the most appropriate occasion to alter the agreed meeting structure.

Since the meeting took place online this year, the SC **agreed** that Greenland would remain the host for the next meeting in 2022. The Secretariat agreed to circulate a list of possible dates in January in a doodle poll to determine the specific time for the 2022 meeting. The exact location will be determined closer to time when the current uncertainties related to travel restrictions are anticipated to be less.

11. RECOMMENDATIONS

11.1 RECOMMENDATIONS FOR CONSERVATION & MANAGEMENT

All Member Countries

- Validate all data (direct catch, by-catch or other) before submission to formal databases and repositories.

Multispecies Approaches to Modelling

All Member Countries

- Ensure the availability of relevant information from seismic surveys to allow for proper sound estimation to meet research and management needs.

By-Catch

All Member Countries

- Since self-reporting is an insufficient basis for quantifying by-catch, always seek additional sources of information (e.g., independent observation)

Norway & Iceland

Reiterated: Improve species identification of by-caught seals (e.g., through jaw or flipper collection, DNA analysis, and/or photographs).

Harbour seals

NAMMCO

- Complete assessments in all relevant member countries as soon as the necessary data is available.
- Discuss the proposal that all catch statistics for harbour seals in Greenland be removed from the NAMMCO website due to known errors and a lack of validation.

Grey seals

NAMMCO

- Complete assessments in all relevant member countries as soon as the necessary data is available.

Beluga

Greenland

- Carry out new surveys in West Greenland in the winter.
- West Greenland: To maintain a 70% probability for population increase, an annual landed catch of no more than 265 individuals south of Cape York and north of 65˚ is recommended
- North Water: To maintain a 70% probability for population increase, an annual landed catch of no more than 37 individuals north of Cape York is recommended.

Reiterated: Implement seasonal closures and no hunt south of 65˚.

Narwhal

Greenland

- Include body length of the animal in reporting requirements.

Reiterated: Reduce catch quota to 0 in all three management areas of East Greenland.

11.2 RECOMMENDATIONS FOR RESEARCH WITH IMPLICATIONS FOR MANAGEMENT AND/OR FINANCIAL IMPLICATIONS FOR THE COMMISSION

Environmental Issues

NAMMCO

- Hold an expert workshop to review the impacts of noise disturbance on hunted populations of narwhals, belugas, walrus and seals from shipping connected to the Baffinland mine.

By-Catch

Iceland

- Continue DNA collection and analysis of by-caught seals to assess the level of species misidentification.

NAMMCO

- Use the estimates from the stratification by management area in population assessments.

Harbour Seals

Norway

- Complete the collection and analysis of DNA samples from harbour seal pups to help determine stock structure and propose more scientifically based management units.

Greenland

- Enhance efforts to identify new breeding and moulting sites for harbour seals in Greenland (particularly in West Greenland) using methods that are most feasible in the different areas.

Grey Seals

Faroe Islands

- Continue the work to provide total summer counts in the Faroe Islands and conduct ongoing monitoring of the breeding sites as well as higher resolution tracking of grey seals.

Beluga

NAMMCO

- Hold a half day workshop to exchange information on effective tagging practices for belugas.

11.3 RECOMMENDATIONS FOR RESEARCH

By-Catch

NAMMCO

- Explain the method for calculating CV in all papers presented to the BYCWG.
- Present an update on the effectiveness of video monitoring systems at the next BYCWG meeting.
- Present a review of the use of pingers in by-catch mitigation at the next BYCWG meeting.

Iceland

- Investigate ways to interpolate the missing depth data in the lumpsucker gillnet analysis.
- Further investigate the possible clumped by-catches of seals and the extent to which these are linked to a particular time period/area/net.
- Explore a combination stratification scheme (e.g. by grouped management areas and season combined.

Norway

- Before the next meeting of the CSWG, pool all seal by-catch data and apportion according to 1) the relative population estimate and 2) the relative harbour seal and grey seal pup/yearling abundance in the management areas.

Grey Seals

All member countries

- Support the development of a Europe wide population model for grey seals through data provision and cooperation.

Norway

- Re-evaluate the robustness of currently assumed immigration rates of grey seals to Norway.

Harp & Hooded Seals

Norway & Greenland

- Carry out data & model exchange to compare performance across species, populations and modelling approaches. In particular, run the NE Atlantic data through the Canadian assessment model.
- Re-assess late-term abortion as a potential cause of the mismatch between high fecundity rates and low pup production in some populations; re-examine Canadian harvest samples to determine signs of late-term abortion in animals with known late-term abortion, followed by a re-examination of harvest samples from the NE Atlantic.
- Modify the model structure for NE Atlantic harp and hooded seal models to examine options for including: a) Late-term abortion term that scales estimates of fecundity to produce more realistic estimates of natality; b) Interannual variation in mortality to account for potential mass mortality or emigration events; c) Density dependence on vital rates; d) Include the effects of potential environmental drivers on seal vital rates and/or carrying capacity.

Beluga

Joint Working Group

- Collate the Canadian catch statistics required to develop a joint model at a future meeting.
- Present the latest research on senescence at the next JWG meeting and investigate how this information may be incorporated into the population model.
- Develop a joint beluga allocation model for the High Arctic/Baffin Bay population, that will consider Greenland/Canada movement data from tagging, dates and locations of kills, and abundance data.
- Hold a half day workshop to exchange information on effective tagging practices for belugas.

Greenland

- Perform a genetic analysis on samples from fall catches in the Qaanaaq area to establish their stock.
- Determine summer grounds and seasonal movements and distribution of the proposed North Water stock.

12. MEETING CLOSURE

The Chair thanked all the participants for their work throughout the meeting and drew the group's attention to fact that Tore Haug intends to retire towards the end of 2021. The Chair took this opportunity to thank Tore for his active and important contributions to NAMMCO over a period of many years. Other members of the SC joined in the round of thanks and shared stories and experiences they had had working in the NAMMCO SC with Tore, several noting that they had also received his encouragement and guidance as postgraduate students. The SC members expressed their thanks for not only the wide range of enjoyable scientific collaborations with Tore, but also the social gatherings that had taken place over the years. The SC collectively wished Tore all the very best for his retirement and hoped that they might continue to see him at NAMMCO meetings in the years to come.

The SC also thanked the Chair for his effective guiding of the group through this online meeting.

13. ACCEPTANCE OF REPORT

A draft of the report text was accepted at the close of the meeting on Friday 29 January 2021. A new version was circulated to the SC on 3 February 2021 following a period of editing and formatting by the Secretariat. An executive summary was also circulated on 8 February 2021. Following the integration of feedback on these versions, the final report was accepted on 12 February 2021.

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APPENDIX 1: AGENDA

27TH MEETING

NAMMCO SCIENTIFIC COMMITTEE

25-29 January 2021, Online

AGENDA

Monday 25th January (13:00-16:00 CET)

1. **Welcome from the Chair & Opening Remarks**
2. **Adoption of Agenda**
3. **Appointment of Rapporteurs**
4. **Review of Available Documents and Reports**
5. **Updates from Council**
6. **NASS Planning**
7. **Collaboration between SC Members - Supertag Project**
8. **Review of NAMMCO Management Areas**
9. **Review of Abundance Estimates Overview**

Tuesday 26th January (13:00-16:00 CET)

10. **Working Group Reports**
    - 10.1. By-Catch Working Group
    - 10.2. NAMMCO-JCNB Joint Working Group
11. **Website Updates & Quality Review**

Wednesday 27th January (13:00-16:00 CET)

12. **Working Group Reports Continued**
    - 12.1. Coastal Seals Working Group
13. **Workshop Reports**
    - 13.1. NAMMCO-ICES Workshop on Seal Modelling
14. **Ecosystem Issues**
    - 14.1. Consumption of resources by marine mammals
    - 14.2. Multi-species approaches to management and modelling
15. **Other Environmental Issues**
16. **NAMMCO Scientific Publications Update**

Thursday 28th January (13:00-16:00 CET)

17. **Species Updates**
    - 17.1. Narwhals (in East Greenland)
    - 17.2. Ringed Seal
    - 17.3. Bearded Seal
    - 17.4. Bottlenose whale
    - 17.5. Killer whale
    - 17.6. Pilot whale
    - 17.7. Dolphins
    - 17.8. Others?
18. **Review of Species-Specific Requests**
    - 18.1. Pinnipeds
    - 18.2. Cetaceans
19. **Future Workplans**
20. **Budget 2021-22**

Friday 29th January (13:00-16:00 CET)

21. **Any Other Business**
22. **Review of Report**
23. **Meeting Closure**

APPENDIX 2: LIST OF PARTICIPANTS

27TH MEETING

NAMMCO SCIENTIFIC COMMITTEE

25-29 January 2021, Online

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APPENDIX 3: LIST OF DOCUMENTS

27TH MEETING

NAMMCO SCIENTIFIC COMMITTEE

25-29 January 2021, Online

LIST OF DOCUMENTS

Working Documents

Doc. No.	Title	Agenda item
SC/27/01a	Draft Agenda	2
SC/27/01b	Draft Agenda Annotated	2
SC/27/02	Draft List of Participants	1
SC/27/03	Draft List of Documents	4
SC/27/04	List of Requests to the SC from Council	Several
SC/27/05	Report from the By-Catch Working Group	10.1
SC/27/06	Report from the NAMMCO-JCNB Joint Working Group on Narwhal & Beluga	10.2
SC/27/07	Report from the Coastal Seals Working Group	12.1
SC/27/08	Report from the NAMMCO-ICES Seal Modelling Workshop	13
SC/27/09	Super-tag Project Description	7
SC/27/10	NAMMCO Management Areas	8
SC/27/11a&b	Abundance Estimates Overview Tables	9
SC/27/12	Minutes from the NASS Planning Meeting	6
SC/27/13	NAMMCO website information on minke whales	11
SC/27/14	NAMMCO website information on pilot whales	11
SC/27/15	NAMMCO website information on harbour seals	11
SC/27/16	NAMMCO website information on walrus	11
SC/27/17	SC accounts and budget	20
SC/27/18	Heide-Jørgensen et al. (2021) Status for the narwhal situation in East Greenland	17.1
SC/27/19	Heide-Jørgensen (2021) Is the East Greenland-Svalbard-Barents Sea stock of Bowhead whales increasing?	17.8
SC/27/20	Pike et al. (2021) Estimates of the abundance of killer whales and northern bottlenose whales from NASS	17.4, 17.5
SC/27/21	Garde et al. (2021) Biological parameters in a declining cetacean population	17.1
SC/27/22	Mikkelsen (2021) Available data on Atlantic white-sided dolphins from the Faroe Islands 2020	17.7

For Information Documents

Doc. No.	Title	Agenda item
SC/27/FI01	Report of SC 26 (2019)	Several
SC/27/FI02	Annual Reports	Several
SC/27/FI03	Report of Council / HoDs Meeting 2020	Several
SC/27/FI04	Report of Management Committees (2019 as no meeting held in 2020) (MCJ + MCC + MCSW)	Several
SC/27/FI05	SC Letter to HoDs regarding new deadline for delivery of meeting documents	5
SC/27/FI06	Response from NAMMCO Chair to letter from SC regarding new deadline for delivery of meeting documents	5
SC/27/FI07	Call for Papers for Volume 12 of the NAMMCO Scientific Publications	16
SC/27/FI08	Heide-Jørgensen, M. P., Garde, E., Hansen, R. G., Tervo, O. M., Sinding, M. H. S., Witting, L., ... & Reeves, R. R. (2020). Narwhals require targeted conservation. *Science*, *370*(6515), 416.	17.1
SC/27/FI09	ICES Activities 2020	
SC/27/FI10	Bengtsson, O., Lydersen, C., Kovacs, K. M., & Lindstrøm, U. (2020). Ringed seal (Pusa hispida) diet on the west coast of Spitsbergen, Svalbard, Norway: during a time of ecosystem change. *Polar Biology*, *43*(7), 773-788.	17.2
SC/27/FI11	Kovacs, K. M., Krafft, B. A., & Lydersen, C. (2020). Bearded seal (Erignathus barbatus) birth mass and pup growth in periods with contrasting ice conditions in Svalbard, Norway. *Marine Mammal Science*, *36*(1), 276-284.	17.3
SC/27/FI12	Kovacs, K. M., Lydersen, C., Vacquiè-Garcia, J., Shpak, O., Glazov, D., & Heide-Jørgensen, M. P. (2020). The endangered Spitsbergen bowhead whales' secrets revealed after hundreds of years in hiding. *Biology Letters*, *16*(6), 20200148.	17
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SC/27/FI26	Moan, A., Skern-Mauritzen, M., Vølstad, J. H., & Bjørge, A. (2020). Assessing the impact of fisheries-related mortality of harbour porpoise (*Phocoena phocoena*) caused by incidental bycatch in the dynamic Norwegian gillnet fisheries. *ICES Journal of Marine Science*.	10.1
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SC/27/FI33	Pike, D. G., Gunnlaugsson, T., Mikkelsen, B., Halldórsson, S. D., Víkingsson, G., Acquarone, M., & Desportes, G. (2020). Estimates of the Abundance of Cetaceans in the Central North Atlantic from the T-NASS Icelandic and Faroese Ship Surveys Conducted in 2007. *NAMMCO Scientific Publications*, *11*.	17
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SC/27/NPR-NO	National Progress Report 2019 – Norway	
SC/27/PR-JPa,b,c	Progress Report 2020 – Japan a) Large Cetaceans b) Small Cetaceans c) Satellite Tagging Experiments (2019-2020)	
SC/27/PR-CA	Progress Report 2019 – Canada	
SC/27/PR-MK	Progress Report 2020 – Makivik Corporation	

APPENDIX 4: OVERVIEW OF AREAS CURRENTLY USED WITHIN NAMMCO

Presented below is an overview of the areas currently used by NAMMCO in the provision of its assessments and management advice. It should be noted that this is not a formal definition of management areas but rather a description of the areas currently in use within the organisation and as such, remains open to change.

CETACEANS

Species	**Regions and/or Management Areas**	**Sub-Areas of Direct Relevance to NAMMCO** (Blue=Unit shared between NAMMCO and non-NAMMCO countries)	**Resource Utilised By** (P=protected; Q=quota)	**Year of Last Assessment** (the year of last assessment by the NAMMCO SC, unless another body is specified)
Common minke whale	Western NAtlantic (W)	West Greenland (WG)	GL (Q)	IWC 2018
	Central NAtlantic (C)	East Greenland Coastal (EGC)	GL (Q)	IWC 2018
		Icelandic Coastal (CIC)	IS (Q)	2017
		Iceland Pelagic (CIP)		2017
		Western Norwegian Sea - Jan Mayen (CM)	NO (Q)	NORWAY
	Eastern NAtlantic (E)	Svalbard-Bear Island West (ES: ESW+ESE)	NO (Q)	NORWAY
		Eastern Barents Sea (EB)		
		Eastern Norwegian Sea (EW) (incl. part FO)		
		North Sea / West UK (EN) (incl. part FO)		
Fin whale	Western NA	West Greenland (WG)	GL (Q)	IWC 2018
	Central NA	East Greenland coastal (EGC*)	P	2017
		East Greenland - West Iceland (EGO* + WI)	IS (Q)	
		East Iceland & Faroes (EI+F)	none	2017
	Eastern NA	Norwegian and Barents Seas (N+W)	P	none

Humpback whale	North Atlantic	West Greenland	GL (Q)	2017
		East Greenland Coastal	P	none
		Iceland - Faroes (incl. CIC)		
		Norwegian and Barents Seas		
Sei whale	North Atlantic	West Greenland	P	none
		Iceland-Denmark Strait		
		Eastern North Atlantic		
Blue whale	North Atlantic	Western North Atlantic	P	none
		Eastern North Atlantic		
Bowhead whale	Arctic	Baffin Bay - Davis Strait	GL (Q)	IWC 2018
		Spitsbergen	P 1911	none
Sperm whale	North Atlantic	North Atlantic	P	none
Bottlenose whale	North Atlantic	North East Atlantic	GL + (FO)#	1995
Narwhal	Baffin Bay	Smith Sound	GL (Q)	2017
		Jones Sound	GL (Q) + CA	2017
		Inglefield Bredning	GL (Q)	2017
		Melville Bay	GL (Q)	2017
		Eastern Baffin Island	GL (Q) + CA	2017
		Eclipse Sound	GL (Q) + CA	2017
		Admiralty Inlet	GL (Q) + CA	2017
		Somerset Island	GL (Q) + CA	2017
	East Greenland	Northeast Greenland	P	P
		Ittoqqortoormiit / Scoresby Sound	GL (Q)	2019
		Kangerlussuaq		2019
		Tasiilaq		2019
	Barents region	Svalbard	P	none
Beluga	Eastern High Arctic - Baffin Bay	North Water to Cape York	GL (Q) + CA	2020
		West Greenland from Cape York to 65°N	GL (Q) + CA	2020

		West Greenland South of 65°N	GL (Q) +?CA	2020
		Southwest Greenland	Extirpated	
	Svalbard - Barents Sea	Svalbard	P	none
Killer whale	North Atlantic	West Greenland	GL	none
		Central and North East Atlantic (possibly 2 units: East Greenland-Iceland-Faroe Islands-Scotland & Norway)	GL	none
Long-finned pilot whale	North Atlantic	West Greenland	GL	catch ass sus^ 2012
		East Greenland	GL	none
		Iceland - Faroe Islands	FO, P(IS)	1997, catch ass sus^ 2012
		Norway	P	none
Harbour porpoise**	Eastern NAtlantic	Greenland	GL + by-catch	2018
		Iceland	P, but by-catch	(2017 IWSHPNA)
		Faroes	FO	(2017 IWSHPNA)
		Barents Sea-Lofoten	P, but by-catch	(2017 IWSHPNA)
		Coastal Lofoten-62N	P, but by-catch	(2017 IWSHPNA)
		North Sea	P, but by-catch	(2017 IWSHPNA)
White sided dolphin	North Atlantic	Greenland	GL	none
		Iceland - Faroe Islands	(FO)	none
		Norway	P	none
White beaked dolphin	North Atlantic	Greenland	GL	none
		Iceland - Faroe Islands	FO	none
		Norway	P	none
Bottlenose dolphin	Eastern NAtlantic	Faroes	FO	none

*C= coastal, O=offshore
= animals that live strand can be killed from shore and used for consumption.
^catch ass sus= not a full formal assessment but an assessment of the sustainability of the present catch level.
** For harbour porpoise by-catch is noted as this is the biggest concern for that species in most areas.
IWSHPNA = International Workshop on the Status of the Harbour Porpoise in the North Atlantic (informal assessment).

PINNIPEDS

Species	Regions and/or Management Areas	Sub-Areas of Direct Relevance to NAMMCO (Blue = Unit shared between NAMMCO and non-NAMMCO countries)	Resource Utilised By (P=protected; pp=partial protection (seasonal, life status etc); Q= quota; su=subsistence harvest; sc=scientific catch) // by-catch is only mentioned when of concern	Year of Last Assessment (year of the last assessment by the NAMMCO SC unless another body is specified)
Atlantic walrus	Arctic	Baffin Bay (BB)	GL (Q, pp) + CA	2018
		West Greenland-Southeast Baffin Bay (WGSBI)	GL (Q, pp) + CA	2018
		East Greenland	GL (Q, pp)	2018
		Svalbard - Franz Josef Land	P 1952	none
Harbour seals	North Atlantic coastal	GL / South-Southeast	P 2010	Status review 2020
		GL / Sioraq (Frederikshåb Isblink)		
		GL / Kangerlussuaq		
		GL / Probably more		
		Iceland	P 2019 (su + by-catch)	2016
		Faroe Islands	Extirpated by mid-19th century	
		NO / Finnmark	NO + by-catch	2016
		NO / Troms		2016
		NO / Nordland		2016
		NO / Nord Trondelag		2016
		NO / Sør Trondelag		2016
		NO / Møre og Romsdal		2016
		NO / Sogn og Fjordane		2016
		NO / Hordaland & Rogaland		2016
		NO / Vestfold & Telemark		2016
		NO / Østfold		2016

		NO / Svalbard	P 1980	none
Grey seals	North East Atlantic coastal	Greenland (visited by strays)	P 2010	none
		Iceland	P 2019 (su + by-catch)	2016
		Faroe Islands	P* 2020	2016
		NO / Finnmark - Lofoten	NO + by-catch	2016
		NO / Lofoten - Stad		2016
		NO / Stad - Rogaland		2016
Harp seals	North Atlantic	Northwest Atlantic	GL (pp) + CA	2019
		Greenland Sea	GL (pp) + NO	2019
		White Sea/Barents Sea	NO + RU(Q=0)	2019
Hooded seals	North Atlantic	Northwest Atlantic	GL (pp) + CA	2019
		Greenland Sea	Q=0 (GL su, NO sc)	2019
Ringed seals	Arctic	West Greenland (Baffin Bay / Davis Strait, area 1)	GL (pp) + CA	1996
		Labrador (input from area 1 & 2)	GL (pp) + CA	1996
		Southwest Greenland (input area 1 & 2)	GL (pp) + CA	1996
		East Greenland (area 2)	GL (pp) + CA	1996
		Svalbard (area 3)	NO (pp)	1996
		Barents and Kara Sea from East Svalbard (area 3)	RU	1996
Bearded seals	Arctic	West Greenland (North Water, Baffin Bay, Davis Strait) (probably more than one population)	GL (pp) + CA	none
		Southwest and East Greenland	GL (pp)	none
		Svalbard & Barents Sea	NO (pp)	none

*: grey seals are not directly protected in the Faroe Islands, but a combination of regulations (including on arms), makes the hunt *de facto* prohibited.

ANNEX 1: JAPAN PROGRESS REPORT 2020 - SUMMARY

The Progress Report 2020 by Japan consisted of three parts: SC/27/PR-JP a) on large cetaceans, SC/27/PR-JP b) on small cetaceans, and SC/27/PR-JP c) on satellite tagging experiments (2019-2020). SC/27/PR-JP a) and b) summarised the following research projects/activities: 1) collection of biological data and samples from special permit scientific research in the western North Pacific Ocean (NEWREP-NP) (large whales); from commercial hunting of small cetaceans; and from commercial whaling on common minke, Bryde's and sei whales in Japan's Exclusive Economic Zone (EEZ). These data and samples are being analysed in contribution to the stock assessment and management of large and small cetaceans in the North Pacific; 2) dedicated sighting surveys for large and small cetaceans under the programs Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A) in the Southern Ocean, International Whaling Commission-Pacific Ocean Whale and Ecosystem Research (IWC-POWER) in the North Pacific (mainly in the Gulf of Alaska) and two national sighting survey programs in the western North Pacific Ocean. These programs involved sighting activities, oceanographic and marine debris surveys, and photo-ID, biopsy sampling and satellite tagging for large whale species; 3) DNA register and molecular monitoring in the retail market for large whales; and 4) records and analyses (mainly on population genetic structure) of by-catches and stranding including small and large cetaceans. Several research institutes and universities participated or contributed to the research in each project. The substantial amount of biological samples and data collected using both lethal and non-lethal techniques in the period mentioned above are being used in analyses relevant to the research objectives of each research project/activity. In 2019–2020, a total of 48 scientific documents were presented to international meetings or published in peer-reviewed journals.

Document SC/27/PR-JP (c) presented the progress in technical development and results of satellite tagging experiments conducted by the Institute of Cetacean Research (ICR) during 2019–2020. The tagging experiments are conducted to respond questions on the habitat and stock structure of large whales. Regarding technical development, the anchor of the tags was modified resulting in a longer tracking period. In the Antarctic, satellite-monitored tags were deployed on the Antarctic minke and fin whales in the Atlantic and Indian sectors in the austral summer. An Antarctic minke whale was tracked for 218 days (Feb. 2nd- Sep. 2nd), moving from Antarctic waters to South Africa coast in the Indian Ocean. Tagged fin whales in Antarctic waters did not show remarkable movements. In the western North Pacific, tagging was conducted for common minke, sei, Bryde's, fin and blue whales. Sei whales showed a wide range of longitudinal and latitudinal movements in the feeding area. In Sea of Okhotsk two fin whales were tracked for 182 and 230 days. These fin whales crossed the Kuril Islands and moved between the Sea of Okhotsk and Pacific Ocean. Another fin whale tagged in the Pacific Ocean crossed the Aleutian Islands, moving into and out of the Bering Sea. The development of satellite tagging technology as well the application of tagging to respond ecological and stock structure questions in large whales are areas of potential collaboration between NAMMCO and Japanese scientists.

ANNEX 2: MAKIVIK PROGRESS REPORT 2020

Beluga

Beluga whales have been harvested by Nunavik Inuit for millennia for subsistence purposes. Nunavik Inuit harvest from primarily two stocks; Eastern Hudson Bay (EHB) beluga and Western Hudson Bay (WHB) beluga. While the two stocks are thought to summer in discrete areas, both stocks share spring and autumn migration routes and overwinter jointly in Hudson Strait and the Labrador Sea. Commercial whaling during the 1800's severely depleted the EHB stock, for which a conservation concern has currently been identified. The WHB has no conservation concern.

Makivik and the Makivik-owned Nunavik Research Centre (NRC) collaborate with the Department of Fisheries and Oceans Canada (DFO) on the monitoring of the subsistence beluga harvest by Nunavik Inuit. The NRC prepares and distributes the sampling kits to communities and coordinates payments to Nunavik hunters who return the samples. Wildlife technicians at the NRC also use the sampled teeth to age the beluga whales. DFO uses the maqtaq/skin sample for genetic analysis for stock identification, and in some years, for examining for presence of parasites or contaminants. Furthermore, the NRC toxicologist has worked with beluga samples to test for the presence of heavy metals (Pb, Hg, Cd, Se) in meat and maqtaq. Between October 2019 and September 2020, the NRC received 139 beluga sampling back from local hunters, although Makivik is increasingly concerned about the robustness of the genetic analyses that DFO are performing, and equally concerned about some of the conclusions that are being drawn from these analyses.

Walrus

The NRC undertakes a sampling program with Nunavik walrus harvesters to test for the presence of *Trichinella* in walrus meat. This longstanding program allows Nunavik Inuit to know that the meat is safe to eat. Hunters send in a sample of the tongue which is then analyzed by trained NRC staff. Usually, results can be returned to the communities within 24 hours of the samples being received by the NRC. Between October 2019 and September 2020, the NRC received 72 walrus tongues for trichinella testing. All these tongues sent in by hunters tested negative for this harmful parasite and the meat was deemed safe for human consumption.

Bowhead

Although there is an annual TAT of two bowhead whales for Nunavik Inuit there was no bowhead whale hunt conducted by Nunavimmiut this year. At this point in time, it is not known when and where the next hunt will take place. In the interim, Makivik has acquired a harpoon gun from Alaska that will replace the current one (which has design flaws) and which equally uses the approved penthrite grenades obtained from Norway.

Narwhal

Nunavik Inuit seldomly harvest narwhal, although it has been noted that observations around Nunavik are increasing.

Makivik and Nunavut Tunngavik Inc. have renewed the narwhal tag transfer agreement, which allows for narwhal tags that have gone unused in Nunavik to be transferred to Nunavut communities the following year.

Ringed Seal

Despite observations from Nunavik Inuit that ringed seal populations in some areas (Ungava Bay, Hudson Strait) are not doing well, there is no dedicated research effort from DFO or academia to better understand the status of these populations. Makivik continues to press DFO to undertake such work. However, the Nunavik Marine Region Wildlife Board is collaborating with hunters and teachers from local communities. Samples are sent to the NRC for the detection of contaminants (mercury), microplastics and parasites (liver flukes, *Toxoplasma gondii* and *Trichinella nativa*). To do so, the NRC

staff as recently acquired PCR and qPCR instrumentation, which will be used to test for *Toxoplasma gondii* in various organs.

After a full year of activity working in their respective community, the project partners will meet together during a hands-on workshop held in Kuujjuaq to plan the next steps of the program. They will discuss the general situation of seals: general state of the population, health and consumption by Nunavimmiut in order to specify the best samples to analyze according to the problems observed (diseases, contaminants, diet, etc.)

Orca

Similar to observations in other marine areas of Northern Canada, Nunavik Inuit have noted a significant increase in the numbers of Orca in the waters around Nunavik. They can now be found, regularly, in Hudson Bay, Hudson Strait, and Ungava Bay. Nunavik Inuit believe that Orcas are altering beluga behaviour, with beluga increasingly moving further up estuaries and into thick ice when orca are near.

Minke Whales

Nunavik Inuit are noting an increased presence of Minke whales, primarily in the Hudson Strait and Ungava Bay area.